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THE GERMAN MILITARY AND ECONOMIC POSITION

December 12, 1941

Coordinator of Information

__Note:__ The following are supporting studies to Monograph No. 3, Coordinator of Information, "The German Military and Economic Position, Summary and Conclusion", dated December 12, 1941.

SUPPORTING STUDIES

I. German Manpower Resources
II. The German Food and Agricultural Position
III. The German Mineral Position: A. Survey
IV. The German Mineral Position: B. Steel-Hardening Alloys
V. The German Mineral Position: C. Petroleum
VI. The German Transport Situation
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GERMAN MANPOWER RESOURCES

December 11, 1941

Coordinator of Information

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GERMAN MANPOWER RESOURCES

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German Manpower Resources

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GERMAN MANPOWER RESOURCES

Summary and Conclusion

1. As early as 1935 the present regime in Germany began to extend a system of controls over employment; by 1936 a large-scale plan for the control of employment and the inventory, training, and re-training, and allocation of labor was in effect. As a result of the carrying out of this plan Germany is in an extremely good position to make the most flexible and efficient use of her labor supplies.

2. At the outbreak of the war in 1939 the potential manpower resources of Greater Germany were already utilized to an extraordinarily high degree. It is estimated that employment in 1939 was 20 percent higher than in the prosperous year 1929.

3. Before the outbreak of the war in 1939, 2,500,000 men were withdrawn from employment into the armed services. At the outbreak of the Russian campaign this number had been increased by approximately 7 million.

4. Estimates based on German sources indicate that, in partial replacement of the 7 million withdrawn from employment, Germany since 1939 has made the following additions to its labor force:

Foreign civilians	1,600,000
Prisoners of war	1,500,000
Women	500,000
Men	500,000
Volksdeutsche	150,000
	4,250,000

5. Industrial output per hour worked showed no net increase between 1933 and 1939, and has undoubtedly declined

since 1939, even among those employed in their normal occupations. This decline has been accentuated by the absorption into employment of less effective foreigners, prisoners of war, and female labor. The decline in productivity per worker has been only partially offset by an increase in the number of hours worked per week.

6. As a result of the reduction and dilution of the labor force, together with some material shortages and transportation difficulties, there has occurred a decline in the volume of industrial output in Germany since 1939 which has been estimated by the BMEW to be as much as 20%. While evidence is lacking to support this figure, it is clear that total output has fallen. This decline did not, however, necessarily reduce the output of war materiel; although it has been a limiting factor on the goods and services available to consumers.

7. Previous to 1939 the shift in production from civilian to military output had been such as to reduce per capita production and consumption of civilian goods by 10-15 percent below the 1929 level. Since 1939 this shift has been accentuated. Perhaps the most illuminating evidence to be drawn from employment statistics is the increase in employment in the metal trades by approximately 2,200,000, an increase of roughly 50 percent.

8. Judgement as to the existence of a general manpower shortage in Germany is a matter of definition. It is

obvious that man-power resources under German control are not sufficient for the maintenance of normal output for German civilians plus the requirements of the present war effort. A more reasonable criterion would be the maintenance of the present war effort plus a tolerable level of civilian output. There are evidences that this standard is becoming increasingly difficult to maintain in Germany, especially since the outbreak of the Russian war, despite the exploitation of Continental man-power and other economic resources.

It is, however, impossible to allocate exactly the extent to which a man-power shortage, as opposed to shortages in transport, raw materials, and productive capacity, is responsible for present strains. Specific evidences of man-power shortage, by this definition are the extraordinaril long hours of work demanded of German labor; and the extreme efforts made to employ special types of foreign labor; e.g., Polish miners, Belgian and Dutch engineers, etc. A general man-power shortage, however, must be regarded as one of several over-all limits to German output, rather than as a bottleneck capable, in itself, of precipitating crisis.

9. Germany's most decisive and least manageable man-power problem is the shortage of men suitable for active combat troops. Here foreign man-power can be used to a strictly limited extent, and war prisoners are useless.

Due to the great fall in the number of births in 1914-18, Germany has only 2,244,000 men between the ages of 23 and 28--about 1,500,000 fewer than if the pre-war birth rate had been maintained. Even including those now 21 to 23, and those 28 to 33, there are only 7.2 million men from 21 to 33, and this is the optimum age group for active combat.

Losses from this group, undoubtedly heavy already, are virtually irreplaceable. This shortage may prove serious in the face of protracted Russian resistance; and may be decisive should the man-power resources of hitherto non-combatant areas ever be fully mobilized against Germany.

GERMAN MANPOWER RESOURCES

1. Control over Use of Manpower Resources[1]

Prior to 1939, the National Socialist regime had developed a thoroughgoing system of controls over the use of manpower resources, and only small extensions of the established machinery were required after the outbreak of war. This system covered control of employment and the inventory, training, retraining and allocation of labor. Large scale apprenticeship and training programs furnished large numbers of skilled and semi-skilled workers required by the armament industry, and the running inventory of manpower provided by the Arbeitsbuch, combined with Government control over hiring and dismissal of workers, placed the Government in an extremely good position to make the most flexible and efficient use of labor supplies. Workers could be shifted between industries, and, after the outbreak of war, moved back and forth between industry and the armed forces in accordance with changing strategic requirements.

Through her system of Government controls Germany was able to make far more efficient use of available manpower, in relation to war requirements, than any of her enemies. Her problems of labor supply have had their origin in the absolute limitations of manpower resources rather than in an ineffective use of such resources.

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[1] This section is based largely on Labor Supply and National Defense (I.L.O., Montreal, 1941).

2. Employment Situation in 1939

As early as 1937, German economic periodicals pointed out that a situation of virtually full employment had been reached and noted evidence of labor shortage in a number of industries. These shortages were less a reflection of economic weakness than of the effectiveness with which Germany's productive resources had been mobilized for war purposes.

Thus, before the outbreak of war, Germany's manpower resources were already utilized to an extraordinarily high degree. The number of wage and salary earners in 1939 was 20 per cent higher than in the prosperous year 1929.[1] Not only was unemployment virtually absent, but the Government had taken systematic steps to draw women into employment, to attract retired persons back to work and to import foreign labor. Moreover, average hours worked per week in German industry increased from 41.5 in 1932 to 46.5 in 1938, and continued to rise in 1939.

Besides the Government's efforts to expand the labor force as a whole, workers were systematically "combed out" from less essential industries to industries which contributed directly to Germany's war preparations, and training and apprenticeship programs were pressed vigorously to provide the skills required in these industries. As an indication of the success of these efforts, the number of persons in the Old Reich attached to the metal and metal products industry increased from 3.5 million in the middle-twenties to 4.5 million in 1939.1/

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[1] Krankenkassenstatistik. Statistik des In - und Ausland, August 1939, p. 39.

In evaluating the labor supply and employment situation at the outbreak of war, the principal factors of significance for the war period are as follows:

1. The possibility of further augmenting the labor force from internal sources was extremely limited. In an analysis issued by the Reich Statistical Office of the German census of 1939, it was concluded that over the next decade, no substantial increase in labor supply would come about either through growth in the adult population or in the proportion of adults gainfully employed.2/
2. The device of shifting workers from the production of civilian goods and services into war industries or into the army, which had begun before 1939, could be carried considerably farther without reducing living standards to a dangerous degree. At the outbreak of war, the volume of consumer goods and services available per consumer was about 15 per cent lower than in 1929, but was substantially higher than in the depression year 1932.

1/ Wirtschaft und Statistik, 1st half October, 1941, p. 353.

2/ Wirtschaft und Statistik, February and April, 1941.

3. Changes in Labor Supply and its Allocation since Outbreak of War

The expansion of the German armed forces has constituted a heavy draft on German labor supplies. The total of gainfully occupied persons in Germany (including Austria and the Sudetenland) was about 40 millions in May 1939, at which time there were about 2.5 million men in the armed forces. Germany has followed the practice of calling up men in preparation for each offensive and of returning men to industrial and agricultural work during periods of military inactivity. Since the Germans, until their plans were disrupted by prolongation of the Russian conflict, determined the periods of lull and of active military operations, the manpower problem was held to a minimum. In preparation for the Russian campaign the armed forces were expanded to perhaps 9.5 millions. The army's additional drafts on German labor power since September 1939 must have been about 7 million men.[1]

In partial offset to this loss, there have been additions to the German labor force estimated as follows:

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[1] This ignores the small losses in earlier campaigns.

	In millions
Additional foreign civilian workers	1.6
Volksdeutsche	0.15
Prisoners of war	1.5
Internal recruits - men	0.5
Internal recruits - women	0.5
	4.25 1/

Thus from the original body of gainfully employed of about 40 millions, about 7 million men have been withdrawn for service in the armed forces; in partial substitution there have been added roughly 4 million workers of various kinds and qualities. The net quantitative loss has therefore been about 3 millions.

The qualitative impairment of the German labor force since the outbreak of war has been of much greater importance, however, than the moderate reduction in numbers. In general, the men withdrawn for military service represent the most active and productive portion of the working population, while the additions to the labor forces have consisted

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1/ Foreign civilian workers. There were about 0.5 million foreign workers in Germany before the war, according to Balogh (Oxford Institute of Statistics Bulletin, August, 1941). The present number is estimated to be about 2.1 millions, according to official statistics revised upwards on the basis of further detailed information. The difference of 1.6 millions have come to Germany since the outbreak of war.

Volksdeutsche. From the Bulletin of International News, October 4, 1941.

Prisoners of war. Reichsarbeitsblatt, October 5, 1941.

Internal recruits - men. Wirtschaft und Statistik, March, 1941, p. 100.

Internal recruits - women. Herr Seldte, in Reichsarbeitsblatt, Feb. 1941, placed this figure at 300,000. Other estimates for women recruits run as high as 1,000,000, but these estimates are probably gross and do not allow for deaths and physically necessary retirements. We have estimated 500,000 to the middle of 1941.

predominantly of persons of far below average prodictivity.

(1) The army has withdrawn from other activities a major part of the male population of most active age. The German armed forces, estimated at 9.5 million men at the beginning of the Russian campaign, contained over half of the men of military age (18 to 45). Withdrawals for military service have been heaviest in the age group from 21 to 33, because this age group provides the most effective combat troops. Moreover, it is precisely within this age group that German manpower resources are most deficient. The German population pyramid shows a striking gap for persons now 23 to 28 years old - those born during World War I. Owing to the low birth rate for these years there were at the beginning of the Russian campaign only about 2.2 million men between 23 and 28 - about 1.5 million fewer than if the pre-war birth rate had prevailed. The total number of men from 21 to 33, from which effective combat troops are drawn, totals only 7.2 million men, and probably at least two-thirds of this group have been taken for military service. Since combat casualties are likely to be largely concentrated in this age group, the problem of replacements can quickly become serious in the event of substantial military reverses. Of the men 21 to 33 left in civilian occupations a part are unfit for military service and some are performing important industrial tasks.

(2) The average productivity of foreign labor, both civilian and prisoners, is far below the average for German workers. Among the foreign workers, Poles and Italians predominate. Out of about 2.1 millions altogether, there are about 870,000 Poles and 325,000 - 400,000 Italians. A few of these are skilled workers, but the great majority are unskilled. Language troubles and differences in technical methods make it difficult to use foreign labor efficiently.

War prisoners are notoriously poor workers and difficult to use. In World War I, the productivity of prisoners in Germany was 40 to 50 per cent below the German average, according to Die Deutsche Volkswirt, and probably the same thing is true now.

(3) The new internal recruits are also greatly inferior in productivity to German workers as a whole. As there was no natural increase in the working population, the net recruitment must have been a result of postponed retirements, recalls from retirement, employment of partially disabled persons, and the employment of women who for one reason or another had not responded to the pressure for more labor from 1937 on.

In an effort to maintain production in the face of a decline in numbers and in quality of the labor force, working hours have been greatly lengthened. Since the war began a 60 hour week has become widespread, and even in mining the work week may be as long as 54 hours.1/

Longer hours have had a considerably less than proportionate effect on production, and have cancelled only a part of the adverse effects resulting from qualitative and quantitative impairment of the working force. Industrial output per man-hour, after increasing from 1925 to 1933, ceased to rise after 1933 and has undoubtedly declined substantially since 1939. On the whole, it can be safely inferred that Germany's total output of goods and services has shown a considerable decline since the outbreak of war. To some extent the decline in Germany's wartime production has been made good by drawing upon previously accumulated stocks and by requisitions and imports from German-dominated countries. Nevertheless, the impairment of German economic life through withdrawal into military service of a major part of the men of active age is, potentially, one of the

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1/ Reichsarbeitsblatt, various issues.

most dangerous elements in Germany's present position. If a lull in military operations permits Germany to return some of these men to productive employment, this danger will be substantially relieved; if, however, Germany's enemies can compel her, over the next year, to maintain an army at approximately its present size, the results may be decisive.

The decline in output as a whole since the outbreak of war reflects a marked reduction in output of civilian goods, offset in part by a further rise in armament production. In the metal and metal products industries - largely armaments - there were employed in May 1939 about 4.6 million wage and salary earners. In the fall of 1939 the German government intensified its program of labor recruitment for this industry. From December 1, 1939, to November 30, 1940, the employment offices assigned a total of 2,246,000 workers of all kinds to the metals industries, as follows:

607,000	metal workers
1,549,000	helpers
90,000	foreign workers
2,246,000	Total

From November 1940 to May 1941, some 50,000 additional apprentices were trained. Thus a total of 2,296,000 workers have been assigned to the metals industries since the war began. These do not all constitute a net addition to the labor force of the industry. Some of the 1939 workers have undoubtedly been mobilized, and there have probably been a considerable number of re-assignments included in the figures above. But even assuming that mobilizations and turnover would reduce the net addition by one-half, there would still be an addition of 1.1 millions, and the number now employed would be about 5.7 millions. Even allowing for a considerable decline in the quality of the labor force, this large increase in workers has undoubtedly made possible an expansion of armament production.

THE PRESENT GERMAN POSITION
WITH REFERENCE TO
FOOD SUPPLY AND STANDARD OF LIVING

December 11, 1941

Coordinator of Information

THE PRESENT GERMAN POSITION WITH REFERENCE TO FOOD SUPPLY AND STANDARD OF LIVING

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THE GERMAN FOOD AND AGRICULTURAL POSITION

SUMMARY

1. Except in meats (rations for which were reduced 20 per cent in June 1941) German food rations have remained about unchanged since early spring 1940. In order to assure most efficient use of available supplies, the German rationing system makes allowance for the differing requirements of various classes of consumers. They are largest for soldiers in active combat, and are larger for workers performing arduous labor than for other civilians.

2. Present German food rations can be most readily compared with pre-war consumption in the three important food groups - flour, meats, and fats and oils. For front-line soldiers, the rations of each of these items are somewhat larger than in 1936-37. For civilians as a whole, average flour rations have been reduced by 6 per cent, fats and oils by 33 per cent, and meats by 46 per cent. The June 1941 cut in meat rations was announced as temporary. Restoration of the pre-June allotments would still leave consumer rations one-third below pre-war. German potato production is far in excess of human requirements, even though this consumption - which is not rationed - has increased by at least 50 per cent for the old Reich as a whole. These increased shipments have further aggravated a transport situation which has from time to time created acute shortages of potatoes in some districts.

3. In terms of caloric, or energy, intake, present German diets appear adequate or nearly so; in terms of longer-run nutritional requirements for vitamins and calcium diets are deficient. Besides lowering resistance to infection, these shortages will, if they persist, result eventually in deficiency diseases such as pellagra and rickets.

4. Without drawing on the Ukraine and without significant encroachment on existing stocks, Germany can maintain present flour rations during the crop year 1941-42. The 1941 grain crop appears to have been normal in Germany, and larger exports than in 1940-41 can be expected from the Danubian countries.

5. Present low meat rations can be maintained in Germany during the crop year 1941-42 without reduction in German livestock herds. This will involve, however, continued, drastic restrictions on meat consumption in German dominated countries as well as additional slaughter of herds in Denmark and the Netherlands. Supplies of animal feedstuffs are, in any event, inadequate to maintain livestock population in these countries. Restoration of German meat rations to the pre-June level would necessitate a reduction in German livestock numbers.

6. Fats and oils are the weakest element in Germany's food position. In the year 1940-41, the German fats and oils stockpile had to supply over 20% of her domestic human utilization of such foods. Stocks on August 1, 1941, were estimated at little more than one month's consumption.

Domestic production can supply only about 60 per cent of requirements at the current level of rationing. Further curtailment of consumption during the coming winter and spring is definitely called for, unless additional supplies not now in prospect can be obtained. The present supply position, however, permits a level of consumption above that of 1916-18.

7. The German standard of living in items other than food has undergone substantial curtailment since the outbreak of war. New clothing rations have been introduced in October which involve a reduction of 50 per cent from those previously in effect. Leather has virtually ceased to be a civilian consumers goods. Fuel for domestic heating has been available only in limited amounts. Most durable consumer goods, already sharply curtailed before the outbreak of war, have become unavailable. In general, however, these shortages are not as dangerous, potentially, as those in nutritional foodstuffs.

8. Only the German situation in meats, fats and oils emerges as of possible strategic importance in the area of the economy examined here. Supplies for the 1941-42 year may not present any insuperable difficulties. But, Germany will enter the 1942-43 year with depleted stocks of these commodities. Her present sources of imports will be able to provide less than in the current year, and, it is unlikely that a victory in Russia can appreciably add to

her prospects. Germany will have to depend more upon home production, particularly of livestock - which supplies the bulk of domestic fats and oils, as well as meats.

9. Allotments of phosphate fertilizers in 1940-41 were about 40% of those in 1937-38. Crop yields in Germany may be adversely affected if increased supplies do not become available for next year's crops.

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FOOD AND AGRICULTURE

I. Prewar Degrees of Self-Sufficiency

In recent prewar years, the old Reich produced more breadgrains than were required for human consumption. Large quantities of rye (as much as 25% of total breadgrains produced) were fed to livestock. Potato and sugar production was also adequate. Considerable amounts of potatoes were available for livestock feeding. With these, the breadgrains fed, and the supplies of domestically-produced beets, the German livestock economy could be considered to be independent of imports of carbohydrate animal feeds. More important was her dependence upon foreign sources for protein feeds, about 11% of her requirements being imported. With respect to meat production, Germany in these years was almost self-sufficient. Indeed, her beef cattle were largely fed on pastures, meadows, fodder crops and other domestically-produced feeds. However, maintenance of the dairy industry, and, in much less degree, the continued production of hogs, depended upon bridging the gap in protein feeds through imports. With reference to fats and oils, Germany always had to import almost half of her requirements.

II. Food Supplies in the Year 1940-41.

Rationing has altered German consumption. The blockade has curtailed agricultural imports from certain areas. Supplies of phosphate fertilizer previously available are now considerably curtailed; military demands have taken labor and tractive power from agriculture:-both factors tend to depress domestic production. Year-to-year changes in stockpiles now play a much more important part in the supply situation. The German conquest and domination of European countries have completely changed their usual role in international trade. Germany has acquired some responsibility to supply Austria with the breadgrains, meats, and fats, in which she is deficient; Czechoslovakia with fats; Belgium and Finland with grains, and so on. On the other hand, German control has provided her with greater power over the disposition of agricultural crops in the conquered lands (particularly surplus areas) and even with some control over the agricultural production of these lands. Effects of all these factors are observable in the changed situation of the German agricultural economy in early summer 1941.

In the crop year 1940-41, the German government had to import and requisition breadgrains to the extent of 7%[1] of the production in the old Reich; even then, significant inroads into accumulated stocks were necessary to meet the requirements for human foods. Production of both wheat and rye in the old Reich and in most of Europe was well below the 1933-37 average. Mostly this was due to abnormal weather conditions; but it was also caused by the successful competition of war for the tractive power and labor in agricultural production. In some measure, the reduced amount of phosphates available was also responsible. On the other side, German requirements were increased because of the need for shipping breadgrains to Austria, the Sudetenland and the Protectorate, Alsace and other areas. (Table I.)

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[1] The figures quoted in these next pages, as well as the balance sheets presented in Tables I-III, are included in a secret report prepared by a committee in the Office of Foreign Agricultural Relations, U.S.D.A., in cooperation with the State Department. The data are based upon estimates prepared by the committee, and checked and expanded by members of the Consular Service. Committee members are Messrs. Michael, Palmer, Arner, and Richter.

Production of meat in the old Reich fell below the consumption requirements under prevailing rations, even when we allow for slaughter of 10% of the hog population and 2% of the cattle population, made necessary by the shortage of protein feeds. Shortage of feeds brought about a reduction of about 15% in production independent of this special slaughter. Meat consumption requirements of the Reich civilian population, German soldiers, foreign workers and prisoners are estimated at 3,200,000 short tons in 1940-41. In addition, Germany supplied Austria and Czechoslovakia with 165,000 tons of meat during this year. Despite such large utilization, German production plus considerable imports from the dominated countries (especially Denmark) provided more than sufficient supplies. (See Table II.) In fact, Germany appears to have increased her stores of processed meats during the year. The Reich, therefore, entered the 1941-42 crop year with carryovers of about 300,000 tons (as against 100,000 tons last year) in addition to livestock "on the hoof" not appreciably below normal amounts.[1] Nonetheless, it is clear that German utilization of meats in the year 1940-41 could not have been met from stocks and domestic production without further herd reductions. Imports and requisitions from the conquered lands were of decisive importance in yielding the present favorable position.

The year 1940-41 made demands upon German fats and oils stocks which cannot be duplicated in the next year. Imports and requisitions amounted to slightly less than 25% of German production, as against almost 100% of domestic production in normal years.[2] Under prevailing rations, requirements including those for the soldiers, prisoners of war, and foreign workers, in addition to Austrian and Czechoslovakian deficits, exceeded amounts made available during the 1940-41 year. It is estimated that Germany had to draw upon her stocks to the extent of more than 300,000 tons in order to balance these requirements. (Table III.)

The Germans had supplies of potatoes in 1940-41 which were ample for human requirements, some export to the conquered lands, as well as utilization for alcohol manufacturing and animal feeding. Similarly, domestic sugar supplies appear to have been adequate. The serious shortage of vegetables in the year 1939-40 was markedly improved during the past year; German production was increased, and imports, especially from Italy and Holland, were greatly improved. Fruits have continued to be scarce; there is some evidence that the severe winter of 1939-40 seriously impaired orchard production.[1]

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[1] The hog population, which has been most reduced, is now of a size more in keeping with available feed supplies.

[2] *Foreign Agriculture*, April 1940, p. 197.

III. Food Consumption during 1940-41

In Table IV are presented the rations effective at the beginning of the Russian campaign. These were pertinent for Aryan civilian inhabitants of the old Reich, and, for the most part, had been in effect since early spring 1940. The meat rations shown were instituted on June 2, 1941, and represent an overall reduction of about 20% from the previous civilian allotments. At the same time, an equal absolute reduction (of about 200 grams) was made in the meat rations of soldiers.[2]

The table indicates the efforts made by the Germans to maintain among consuming groups differentials which tend to match different body requirements. Extra-heavy workers receive more than twice the flour allotment of the normal consumer. They receive more than double the amount of meat and about three times the quantity of fats and oils. Were these data grouped on a family basis, they would reveal the fact that larger amounts were being made available to the larger families, particularly to those families with large numbers of young children and with more than proportionate numbers of adults in the special work categories.

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[1] There are estimates of an 18% reduction in German orchards. (Report of Committee referred to in footnote, p.2)

[2] M.E.W. Report #88. The reduction was to pertain to summer months only. As yet, no restoration of the larger amounts has been indicated.

How adequate these rations are may be judged in some measure from comparison with the prewar consumption levels of 1936 and 1937. (See Table V.) Unfortunately, there exist no figures for this period by occupation and population groups comparable with the ration categories. Indeed, even figures for consumption by normal consumers are not available for that period. The estimates of prewar consumption shown in the table were adapted from total consumption statistics, from the 1927-28 budget studies, and from some budgetary material collected in 1936-37.[1]

In interpreting the changed consumption in each occupational class, one must remember that the number of persons in each has altered. In general, there has been a shift into the groups receiving larger rations. The 1940-41 population distribution shown in Table V is an estimate. Nonetheless, the only figure which appears seriously out of line is that for soldiers. The estimate of

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[1] These computations were made by J. H. Richter, Office of Foreign Agricultural Relations, U.S.D.A. See Foreign Agriculture, October, 1941, pp. 437-440.

5,000,000 certainly understates the number in June, 1941.[1]

The 1940-41 consumption of all consumers, weighted by their numbers, was below the prewar level for the three important food groups examined. For breadgrains there is a reduction of only 6% below this earlier level. However, important consumer groups show increased consumption, while the grain supplies of no group are appreciably curtailed.[2] The average for fats and oils is two-thirds of the prewar consumption. For meats, the rations in effect through most of the year were also two-thirds of prewar data. (Weighted average consumption in the period since June 1, however, was down to 54% of prewar.) The soldiers' diets were increased above prewar levels for all foodstuffs studied. They had 15% more fats and oils, 5% more cereals, and, throughout most of 1940-41 at least, almost 50% more meats. (When rations were reduced in June, 1941, the figure for comparison still showed an increase - of less than 20%.)[3]

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[1] M.I.D. calculates 7,500,000 men; there are other estimates which exceed 8,000,000. In the calculations made below for the year 1941-42, I have allocated soldier rations to 6,500,000 men. This estimate appeared justifiable in computing food requirements, since a considerable part of the soldiers receive "other troop" rations (equal to that of heavy workers) and some even receive garrison rations, which may not exceed those of normal consumers. In the food requirement computations I used "front line" rations for all soldiers.

[2] The figure of 71 for farmers and farm workers is an exception. The comparison for this group, however, is least significant, since both prewar and recent consumption figures are subject to wide margins of error.

[3] The meat rations indicated are for "first-line troops"; there is a lower ration for other troops. See note 1 above.

Undoubtedly, there has been a marked increase in potato consumption throughout Germany. Conservatively, this has resulted in a minimum increase of 25% in the diets of all; more probably, increases of as much as 50 or 75% are pertinent for large groups in the Reich.[1] Utilization of sugar for domestic purposes was also increased in 1940-41, to a level slightly above the prewar figure, though this was made possible by some reduction in sugar used industrially. There is some indication that vegetable supplies for the nation and perhaps even for non-military consumers were maintained at prewar levels, while fruit available for civilian consumption was well under the levels of more normal periods.

Such comparisons with prewar consumption are revealing. Yet there is no reason to suspect that prewar levels provide an adequate base from which to measure. Thus, there is some evidence that the German program of "planned consumption" had oriented diets by 1937 to a point where they were already below some level of nutritional adequacy.[1] An attempt was therefore made to compare the food value of the current rations with accepted nutritional requirements. Briefly summarized, it can be said that the sedentary workers, long and night workers, heavy workers, and children appear to be consuming calories enough to meet the requirements of their activities. The moderately-active workers (probably not engaged in war industries) and the extra-heavy workers (upon whom the greatest non-military burden rests) do not consume enough calories to permit them to work an eight-hour day. The deficit is probably not greater than 5% of their needs, however, and the loss of efficiency from this cause would be slight. A longer working day would, of course, increase caloric requirements proportionately.

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[1] It seems to be true that total human consumption in the old Reich has risen (1940-41) to 20-22 million tons, as compared with 12-13 million tons in prewar years, an overall increase of 75%. (See dispatch from Berlin, New York Times, November 15, by Waldemar Hoeffding.) Such amounts are consistent with dispositions of the large 1940 crop for animal feeding and for distillation to make industrial alcohol. This does not mean that extreme shortages have not occurred at times. These were particularly frequent in the deficit areas at the end of the crop season (May-June, 1941.) In large part also they were occasioned by tightness in the transportation service. In interpreting these, it must also be remembered that at times supplies in these same areas were extremely abundant - the human ration frequently being fed to the backyard livestock.

The protein allowance of all groups, both adults and children, is well above standard, though it should be noted that the ratio of vegetable to animal protein (about 55 to 45) is almost the reverse of the proportions before the war. This makes the diets bulky and less easily digestible, especially for the children. The calcium allowance, however, is a bare minimum for adults and slightly above minimum for the older children, who should be allowed a considerable margin to ensure healthy tooth and bone formation. Iron consumption similarly appears adequate on the average, though with such a slight margin of safety that those whose individual needs are above average will probably suffer from nutritional anaemia.

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[1] See Strauss, Frederick, op. cit., pp 5-8.

The most serious deficiencies probably are occurring in relation to the vitamins - particularly A, D, and G (riboflavin). Their richest sources are the foods of animal origin, consumption of which has been most drastically curtailed.[1] These deficiencies will eventually result in rickets (for the children), night-blindness, and pellagra--all of which will be seriously detrimental to production, efficiency and morale. Even where these diseases do not occur, continued underconsumption of the protective foods--milk, eggs, butter, fresh fruits and vegetables--will lower the resistance to infection of all classes of the population.

In sum, we may conclude that the dietaries which the Germans were able to provide the 70.2 million inhabitants of the old Reich in 1940-41 were adequate to prevent starvation. Yet food allotments for some were probably not sufficient to sustain working efficiency over long periods. But no specific statement as to the present extent or future results of such inadequacies appears warranted--at least in the old Reich today.[2] The German authorities have attempted to minimize the loss of efficiency accompanying substandard diets by introducing a rationing system which takes account of the nutritional demands of different occupation groups. Therefore, while the diets of the nation as a whole have deteriorated when food consumption is placed on a per capita basis, the heavy and extra-heavy workers (upon whom

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1. Since 1940 synthetic vitamin A has been added to margarine to make it nutritionally equivalent to butter in this respect. But it is very unlikely that this has been sufficient to compensate quantitatively for the scarcity of vitamin A rich foods.
2. There are many accounts of cases of "collapse while at work", etc., in the Buxton reports.

falls the brunt of the civilian war effort) are better fed now than the "normal" consumer was in 1937-38. Since there has been a shift of a considerable number of the prewar "normal" consumers into the worker groups in the past three years, this means that some individuals are actually eating more than they were earlier. This does not alter the fact, however, that these same individuals, as well as the rest of the people in the heavy-worker categories, are consuming somewhat less than the nutritional requirements imposed by their strenuous tasks. Moreover, the heavy workers are being fed largely at the expense of the "normal" consumers, whose consumption of grains was down 8%, meats 57%, and fats and oils 37%, as compared with their prewar consumption.

IV. Food Situation and Outlook, 1941-42.

The Russian enterprise was undertaken at the end of the 1940-41 agricultural year. Germany was looking forward to her own harvests. Her wartime scale of consumption was very dependent upon supplies from other countries, particularly the dominated areas of Europe. Production and domestic consumption in these lands were both integral elements of Germany's food picture during the campaign, and indeed for the year 1941-42. War with Russia cut off some supply sources, and certain supply routes; it placed new burdens upon a transportation system which was already very heavily taxed during periods of crop movements; it bore directly upon labor, machine, and power sources required for agricultural operations. Moreover, a campaign like that in Russia, where military activity shifts emphasis rapidly among different areas on a broad front, requires the maintenance of many food stores. The uncertainties of battle necessitate the building up of emergency reserves at any point which will probably exceed what will be consumed. Hence army consumption reduces amounts immediately available for civilians by more than a corresponding amount.

There is little specific information on any of these matters. There are only some preliminary estimates of agricultural production in Europe in the current season. What follows has been pieced together from information and suggestions on many scattered points. Attention is focused upon the three main food groups - grain, meats, and fats and oils - in an attempt to project the food balance framework into the agricultural year 1941-42.[1]

Evaluation of the 1941-42 situation for breadgrains suggests that Germany will have to reduce her carryovers but slightly in order to maintain her present (adequate) rations and also meet essential demands of other European nations. (Table VI) a rye crop which is estimated to be normal and a wheat crop which is probably some 5% below prewar levels should provide the Reich with a harvest of 13 million tons of grain. Principally because of the large wheat crop in Rumania, the Danubian countries may be expected to increase their breadgrain exports to Germany from 250,000 tons in 1940-41 to 750,000 tons in the present year.[1] Harvests in German Poland should match those of the past year; there is no basis for assuming the Germans will release any larger share to the Poles than they have previously. Imports from Poland are therefore assumed to remain unchanged. On the requirement side, only two items are appreciably altered.[2] The poor quality of the harvest increases by some 35% the amount of breadgrain unfit for milling. Conditions in the conquered lands will require some shipments of breadgrain. There are estimates of such amounts as 300-400,000 tons for Greece; Belgium will require at least 150,000 tons; Finland and Norway will need some 100,000 tons.[3]

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[1] Computations were made for a Reich population of 71 million persons in 1941-42. Included were 6,500,000 soldiers. (See footnote 1, p.7. To permit this increase, population was shifted from the normal consumer and farm categories shown in Table V.

Even with these shipments, the balance sheet in Table VI suggests that the Reich will have a carryover in August 1942 which is not too much reduced from the level with which she entered the present year. Even were the

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1. See, for example, M.E.W. Report, Accession #950. These quantities will be made available only by serious impositions on domestic consumers. Germany has been very successful in tapping the surplus areas. This is particularly true of Yugoslavia (especially the Batchka-Baranya-Banat area, which is now Hungary).

2. German requirements in the Reich were calculated on the assumption of the maintenance of previous rations to a population of 71 millions, including soldiers. In addition, 3.5 million workers and prisoners of war were assumed to have been fed the ration of normal consumers.

3. Cf. M.E.W. - Reports. Accession numbers: 2278, 2279, 2280, 2282.

estimates of millable grain high, the imports from the Danubian countries also overestimated, and the essential demands of conquered countries greater than suggested, it is likely that Germany will be able to maintain her present rations through 1941-42. At worst, her bread rations for the fourth year of war, 1942-43, would be endangered,[1] though even this appears unlikely today.

A very tentative picture of the balance for meats in 1941-42 has been drawn up in Table VII. Primarily because of the deficit in the quantity of protein feed grains and a general deterioration in quality of the feedstuffs fed, there will probably be a reduction in meat produced from animals fed during 1941-42. Much depends upon the quantities of feed that the Danubian countries can make available. The quantities which Russia had sent Germany in 1940-41 were of great importance in the German feed balance, and contributed significantly to the German production of 2,750,000 tons in 1940-41. In view of the changed feed situation and the reduction in numbers of livestock, German domestic production for the 1941-42 season is estimated at 2,500,000 tons.

The total quantity of meat that Germany can expect to import and requisition from the conquered countries may not be very much less than was obtained last year, though the amounts coming from different areas have changed. Denmark may well increase her shipments to

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[1] Possible German acquisitions from Russia are important here.

Germany. Largely, this will come about through the further slaughter of livestock which she will be unable to feed. Also, there has been a reduction in domestic consumption, due to the increase in price. All in all, the export surplus should be more than the amount usually available. The Netherlands will not be able to export hog products in any significant amount, if at all. Total imports from this country will be markedly reduced. Whatever imports do occur will have to be brought about by further reduction in cattle numbers.

Increased imports from the Danubian countries are expected. Here the quantities made available will be in no small measure the result of forcing down domestic consumption. The meat rations in the urban centers in southeastern Europe are already very low. There are two meatless days a week in Budapest and Belgrade, four in Sofia, while in Bucharest the monthly meat ration of 250 grams per capita is completely inadequate.[1] However, even such extreme suppression of urban consumption cannot make too great supplies available to Germany. It is much more difficult, perhaps almost impossible, to ration rural areas. Even the procurement of significant supplies in producing areas which are not normally surplus is a very difficult task. German experience has already discovered that it is virtually impossible to set up in any short period a system of food collecting in a producing area which has not already developed a collecting structure. Even with the cooperation of the peasants, the task of curtailing their home consumption is a difficult one. In areas where there is no such cooperation, the Germans have discovered that very large administrative activity is necessary in order to obtain the supplies from the farmer.

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[1] See M.E.W. - Report. Accession No. 1351

The Germans should be able to curtail the consumption in cities. They may be successful in requisitioning the surplus from rural exporting regions. Experience has already demonstrated that the imposition of low rations upon producers in deficit areas cannot succeed.[1] An estimate of 125,000 tons, an increase of something over 10% in the amounts made available by the Danubian countries in 1940-41, seems not to be a conservative one for import supplies which Germany can expect during the current year.

Should the Germans return to the meat rations in effect at the beginning of the summer (which seems to have been their intention) German requirements for the old Reich, German soldiers, prisoners of war, and foreign workers for 1941-42 will amount to more than 3.3 million tons. This exceeds the total supplies which it now appears will be available. In addition, Germany will have to meet certain deficits in Austria, Czechoslovakia, and other regions in Greater Germany. On the basis of the restoration of previous ration levels and the export of 250,000 tons, the Germans will require about 350,000 tons more than current production and imports will make available to them. However, the German livestock position "on the hoof" is a strong one, and this quantity can readily be met through slaughtering. Moreover, should there be no upping of the meat rations to earlier levels, the supplies available without further herd reductions will suffice and may even permit a very small carryover into the next year. It does not appear likely that the Germans will continue throughout the year without some upward revision in meat rations. There is thus reason to believe that Germany's meat balance will be maintained in 1941-42 only at the cost of unfavorable production prospects in the following year. This is true not only for the old Reich, but also for the areas from which Germany imports.

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[1] See the account of the French, Italian, and Belgian experiences of M.E.W. Reports; Accession No. 408

It is important to note that the Germans seem to have obtained little, if any, meats in the Russian campaign. Indeed, it appears that the Reich must ship to its army the quantities that the army consumes. The areas which the Germans now hold and in which fighting is now taking place are not surplus regions. Furthermore, the Russians seem to have been very successful in clearing the area of livestock. One may remark that the Germans may not even be supplying the troops in the Netherlands and in occupied France with meats from these countries.[1] It appears that most of the German soldiers must be supplied from the stocks indicated in our balance. This intensifies the supply situation, in addition to adding heavily to the difficulties of transport.

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[1] M. E. W. Report; Accession No. 2280

With reference to fats and oils, it is again indicated that German domestic production will be decreased. It is unlikely that tallow supplies or quantities of hog fat will be available from domestic sources in the amounts produced in 1940-41. With respect to imports and requisitions, the situation is not very clear. It appears that butter supplies from Denmark will exceed those in 1940-41. The Danish production has declined, and requirements should increase, since the margarine supplies will be very low. The Danish margarine stocks depend upon imports of vegetable oils from other countries, which Germany may not make available to Denmark. Nonetheless, the more important factor is that price increases are curtailing Danish butter consumption. The Danes, at further cost to their own consumption standards, may be able to export 100,000 tons of butter.[1] Smaller amounts, however, will be made available from the Netherlands, where, again, butter production runs into the same difficulty as that in Denmark.

The German import situation is most indefinite with reference to imports of vegetable oilseeds and of olive oil. Some increases in these two categories have been indicated in the balance sheet, though these are rough estimates. Much depends upon Germany's policy with

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1. Report of Committee

respect to quantities of vegetable oil made available to the dominated countries. In a sense, by curtailing such quantities, she aggravates the domestic butter situations in these countries and endangers her butter supply.

The Germans have contracted to receive 2,000 tons of olive oil from Turkey.[1] Supplies from Italy and Spain may be increased over the previous year, particularly since the Spanish olive crop is about 50% above last year's.[2] However, vegetable oil imports from North Africa will be much smaller than last year, because the production there has fallen by 50% from 1940 figures, and is even below the normal production of about 70,000 tons.[3] Germany has access to French African supplies through France.

On the above bases, it is estimated that the total German supplies of fats and oils, including carry-over stocks, will be below 1,500,000 tons for 1941-42. Rations for the 1941-42 population including the army if the rations are assumed continued at the present rate, will themselves require more than 1,500,000 tons. Moreover, the deficit Germany will have to meet in other areas will certainly exceed that of previous years. It has been estimated, for example, that the Belgians will require as much as 30,000 tons of vegetable oils even to maintain butter and margarine consumption at the present low levels.[4] The deficit for 1941-42 appears to be of the order of

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1. M.E.W. Report; Accession No. 2278
2. Report of Committee
3. M.E.W. Report; Accession No. 2281
4. M.E.W. Report; Accession No. 2279

300-400,000 tons.

If our approximations are reasonably accurate, the German fats and oils situation will become very acute by midwinter and early spring. There is indication that Germany may be meeting this situation through a further reduction in rations, thus making even less than 50% of prewar consumption available to a majority of German consumers. On the other hand, further supplies may be acquired. At greater cost to Spanish consumers, German supplies of olive oil may be further increased. The Danubian countries may be able to increase exports to Germany by as much as 50,000 tons. In one way or another, Germany may be able to tap the large peanut stock now held in Dakar. It is with respect to fats and oils that the German food situation will be most extreme during 1941-42. Germany will miss considerably the large supplies of vegetable oils which Russia and supply lines through Russia had given her in 1940-41. Nonetheless, the possibility of acquisitions in excess of those given in the balance sheet and as indicated in the text, plus a reduction in fat rations[1], makes it impossible to conclude that the food situation will bring about a break in Germany during 1941-42. However, again as in the case of meats, Germany will face extreme fats and oils possibilities in 1942-43.

V. Conclusion

The Russian campaign bore directly upon the German food situation by depriving the Reich of fodder and oil supplies which were important to her food economy. Also, the transportation burden imposed by the Russian campaign and the special aspects of it made necessary by the extent to which Germany must feed her military forces with supplies transported to the front, have aggravated the food distribution problem within Germany considerably. Temporary food shortages in important deficit areas have occurred, even during periods of more abundant supplies. These shortages have frequently been severe. Undoubtedly, 1941-42 will see intensification of these temporary shortages, and an increase in their frequency. This will make the occasional reports which we have of extreme shortages more impressive. But it is not likely that they depict any more extreme overall shortages than those suggested in this memorandum.

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[1] Such a reduction might still leave German consumers with larger amounts of fats and oils than they had in 1917-18.

Less directly, the Russian campaign has made new demands upon labor supplies and mechanized equipment. The German harvests were probably not affected thereby. This is less true of harvests in conquered countries upon which Germany has depended.

Nonetheless, it does appear that the Russian campaign will not affect the German ability to hold out in food for 1941-42. Indeed, it seems that had the campaign been delayed beyond 1941-42, no similar period of such independence could be visualized. If the Russian campaign is successfully completed before 1942-43, it is conceivable that the food situation in Germany may be ameliorated and the 1942-43 requirements be fulfilled. However, the task of agricultural exploitation of the U.S.S.R. will be a formidable one. Unless the Russians are completely defeated, oilseeds imports from the Far East may still be impaired. It is unlikely that Russia can contribute appreciably to the 1942-43 meat situation in Germany. It appears, therefore, that even with a successful conclusion of the Russian campaign before the end of the present crop year, the Germans - and certainly the conquered lands - must look forward to extreme food conditions in 1942-43.

VI. Supplement - Standard of Living

Expenditures by the German government amounted to about 25 per cent of national income before the present war; today such expenditures require at least 50 per cent. Withdrawals of this magnitude constitute a huge drain on income available for consumer expenditure and for capital outlays destined to produce consumers' goods. Nonetheless, if successful completion of the war is an essential part of the happiness and contentment of the German consumer, the government's outlays must be considered well spent in the objective of maintaining and even increasing the content of living. Furthermore, the large expenditures mean employment security for the German worker. Large numbers of German consumers may welcome the freedom from concern about maintaining their jobs, however much they chafe under the controls which accompany such security. No generalizations can be made as to the net effects of these factors upon German living standards. The only effects of the German expenditures with which we are concerned here derive from the fact that such expenditures necessitate withdrawals from consumer wages and salaries.

With reference to standard of living as evidenced by consumer expenditures, there is little doubt that the German consumer had less real goods available even before the war than he had in the years 1928 and 1929. By deducting the German figures for amounts paid in taxes, duties, social insurance, winter help, and other "voluntary" contributions, and total apparent savings, from the total national income, there emerge the amounts available for civilian consumption.[1] Even when corrected by the official cost-of-living index, these computations show that in 1938 real income available for consumption per full consumer had declined by 10 per cent from 1929. There is much evidence that the cost-of-living index overstates the decline in prices during this period.[2] A more realistic estimate of the reduction in real income is about 15 per cent. Since there has been no significant shift in income distribution among classes of German consumers, and since average incomes in Germany are close to the level of the working class groups, this statement is essentially correct for all income groups. There was actually a decline exceeding 15 per cent for the upper groups, and one slightly under 15 per cent for the lower groups.

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[1] This is the procedure followed by Frederick Strauss in his "Income and Consumption in Germany during the Rearmament Period," U.S.D.A. Mimeograph, August, 1941. There may be some question as to the advisability of deducting savings, since in many respects these represent a voluntary decision on the part of consumers to forego present consumption for some future return. Their total is small relative to contributions, however. Moreover, there is considerable indication that amounts saved are 'forced', if not by direct government action, then by the unavailability of supplies of consumer goods.

[2] See _Vierteljahrshefts zur Wirtschaftforschung_, Vol. 14, Heft 1, pp. 14, 15; Strauss, _op. cit._, pp. 31-36; Nathan, Otto, Report to Leon Henderson, pp. 22-23. The "full consumer" is a variation of the per capita concept which takes into consideration age and sex distribution.

The German data will not permit extension of the above presentation into the war years. However, the case for further reduced standards of living is a clear one. With the advent of the war, the proportion of national income going to military expenditures increased at least to the point where it absorbed half of what Germany produced. This meant a further reduction in consumption goods, particularly consumer durables, in which civilian consumption of products involving most metals has been completely eliminated. The German consumer has therefore been able to purchase fewer commodities, regardless of the amount of his (monetary) gross income receipts. Government withdrawals in the form of taxes, duties and contributions have increased; again, more "savings" have occurred.

It is important to note that German wage earners and salaried workers spend almost sixty per cent of their income upon food. Food expenditures take two-thirds of the budgets of the lower-salaried workers. (Data are for 1938.) Therefore, changes in food consumption are the most important determinants of the changes in German living standards. This subject we have already investigated in the food and agriculture section of this report. The bulk of German consumers have had less food since the outbreak of the war than they had at its beginning. The present reduced dietaries - which were seen to be of lower nutritive value - appear to absorb an even larger proportion of the German consumers' income available for consumption than did their foods in 1938. For, though the official cost-of-living index has remained relatively unchanged, evidence can be presented to show that it has actually increased significantly since 1938.[1]

Eighteen per cent of the budgets of wage earners and salaried workers is devoted to rent, fuel, and light. Both fuel and light compete with the demands of the war machine. Furthermore, the transportation of coal to urban centers has been made much more difficult during the last few months. Though no precise estimates can be obtained on the extent of the coal shortage in urban areas during the coming winter, it seems true that at least coal allotments will be down from the prewar winter.

With respect to textiles the current situation is reflected in the new rationing system. The third clothing card (effective October and November, 1941) has only 120 points as compared with 150 on the second card. Moreover, this reduced number of points extends for a longer period, and only 100 points "mature" on given dates. The remaining 20 become available only when special notice is given. The effect of these changes is to reduce the clothing ration by 50 per cent below the level of the previous ration. The consumer's position has been further impaired by the addition to the rationed class of numerous articles, such as hats and rubber rain coats, the purchase of which had formerly not required the surrender of coupons. Not only has the quantity of textile products which the German consumer is allowed to purchase been reduced, but the quality of the goods has deteriorated. Synthetic products account for an increasing share of total textile supplies.

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[1] For example, see Strauss, op. cit., pp. 32, 33. Shortages have necessitated purchases of higher quality foods. Usual grades at the fixed prices were not available.

The rate of production of leather in Germany plus what could be obtained from conquered and other countries provided an amount which exceeded estimates of Germany's annual military needs by only a small margin. Supplies acquired from other countries came principally from stocks. Further takings must therefore be at a reduced level. Hence, there is practically no leather available for German consumers. This is attested by the reports of the unavailability of shoes in stores, the restriction upon shoe repairs, the development of (second hand) shoe exchanges, and the wide use of wooden-soled footwear.

The Russian campaign has affected the German standard of living principally through its influence upon the German food situation. Both by aggravating transportation difficulties and by curtailing textile supplies, it has had adverse influences upon the other elements in the standard of living. Increasingly, the influences reducing living standards will continue, at least until the Russian campaign permits some redistribution of rolling stock and makes available new supplies and supply lines. As a strategic factor in the German war effort, however, no importance can yet be attached to this deterioration.

TABLE I

Germany: Estimated Wheat and Rye Balance, 1940-41

Supply		1,000 Short Tons	Requirements		1,000 Short Tons
Carryover, August 1940		6,600	Seed and waste		1,550
1940 Crop, Old Reich		11,600	Rations for Old Reich population, all German soldiers, and prisoners of war: and foreign workers	9,100	
Imports & Requisitions, 1940-1941:			Less 5% allotted in farinaceous foods other than wheat & rye	450	
Danube Countries	250				
Russia	200				
Western Poland	350		Net	8,650	
		800	Less 5% potato flour admixture	450	
			Net wheat and rye flour	8,200	
			In terms of grain at 80 p.c. extraction		10,250
			Austrian deficit 1940-1941		450
			Sudentenland and Protectorate deficit 1940-1941		200
			Feeding of 1940 breadgrains not usable for human consumption		800
			Sundry requirements (for Alsace, and some other countries)		350
			Carryover August 1941		5,400
		19,000			19,000
Carryover August 1941		5,400			

(Source: Committee, Office of Foreign Agricultural Relations and State Department.)

TABLE II

Germany: Estimated Meat Balance, 1940-1941

Supply	1,000 Short Tons	Requirements	1,000 Short Tons
Carryover, August 1940[3]	100	Rations for old Reich population, all German soldiers, prisoners of war and foreign workers..........	3,200
Domestic Production 1940-41:			
Currently produced from feedstuffs fed in 1940-41[1].........	2,750	Deficit: Austria & Czechoslovakia....	165
Supply added by reduction in numbers during 1940-41[2]........	275	Carryover, August 1941[3]...............	290
Imports & Requisitions 1940-41:			
Denmark 200			
Netherlands 110			
Danube Countries 110			
Other Countries 55			
	475		
Supply of fats in sausages & other charcuteries sold as meat......	55		
	3,655		3,655
Carryover, August 1941[3]	290		

1. Pre-war production: 3,300 less 16 percent because of less feed.
2. Reductions: hogs 10 percent, cattle 2 percent.
3. In government hands.

(Source: Committee, Office of Foreign Agricultural Relations and State Department.)

TABLE III

Germany: Estimated Fats and Oils Balance, 1940-1941

Supply			1,000 Short Tons	Requirements	1,000 Short Tons
Carryover August 1940[1]			500	Rations for Old Reich population, all German soldiers, and prisoners of war, and foreign workers	1,500
Domestic Production 1940-41:					
Butter	600			Deficit: Austria and Czechoslovakia	120
Edible oils	20				
Pure vegetable fats	---				
Margarine, etc.	30			Supply of fats for sausages and other charcuteries consumed as meat	55
Hog fat	400				
Edible tallow	50		1,100	Carryover August 1941[1]	180
Imports & Requisitions 1940-41:					
Butter:					
Denmark	90				
Other countries	55	145			
Lard and fatbacks		55			
Margarine (from imported oilseeds)		20			
Edible oils (olive oil from Italy and Spain)		35	255		
			1,855		1,855
Carryover August 1941[1]			180		

[1] In government hands.

(Source: Committee, Office of Foreign Agricultural Relations and State Department.)

TABLE IV

Weekly Food Rations Per Person
(in effect at start of Russian Campaign)

	Normal Consumers	Long & Night Workers	Heavy Workers	Extra-Heavy Workers	Children			
					0-3 Years	3-6 Years	6-10 Years	10-14 yrs.
	Grams	Grams	Grams	Grams	Grams	Grams	Grams	Grams
Bread, flour & cereals, in terms of flour	1,800	2,250	2,850	3,600	1,100	1,100	1,388	2,063
Sugar[1]	225	225	225	225	225	225	225	225
Marmalade	150	150	150	150	150	150	[2] 150	[2] 150
Meat[3]	400	600	800	1,000	250	250	400	400
Fats and oils	268.7	288.8	393.8	737.5	125	187.5	259.4	259.4
Cheese	[4] 62.5	[4] 62.5	[4] 62.5	[4] 62.5	[4] 62.5	[4] 62.5	[4] 62.5	[4] 62.5
Artificial Honey	(5)	(5)	(5)	(5)	[6] 31.3	[6] 31.3	[6] 31.3	[6] 31.3
Curds	31.25	31.25	31.25	31.25	-	-	-	-
Whole Milk	(7)	(7)	(7)	(7)	5,250	3,500	1,750	1,750
Skimmed Milk	(8)	(8)	(8)	(8)	-	-	-	-
Eggs	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)

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[1] Special allowances made for jam-making in the season.
[2] Plus an extra allotment of 50, not convertible into sugar.
[3] Rations include 20 percent bone. [4] Sometimes only 46.88 grams per week. Sometimes replaced by 170 grams of condensed milk, or consumers given the choice of taking 125 grams of curds in place of 62.5 grams of cheese. [5] 125 grams every 3 months. [6] Plus 125 grams every 3 months.

[7] As a rule, reserved for children. However, expectant and nursing mothers, invalids, sick people, & workers in certain occupations detrimental to health (chemical industries) may apply for 3½ liters (about 3,500 grams) per week. [8] Freely available, but supply clearly limited. [9] Allowances apparently varying depending on the season. 1 to 2 eggs per person to urban population during first 2 years of war.

TABLE V

Weekly Rations of Flour, Meat, Fats & Oils, Estimated Pre-War Consumption with Comparison

Consumer Group	Recent Pre-War Years				Current Consumption				Current Consumption as % of Pre-War		
	Percentage of Population[1]	Estimated Consumption[3]			Percentage of Population[4]	Rations					
		Flour	Meat[2]	Fats & Oils		Flour	Meat	Fats & Oils	Flour	Meat	Fats & Oils
	Percent	Grams	Grams	Grams	Percent	Grams	Grams	Grams	Per-cent	Per-cent	Per-cent
Normal consumers	54.10	1,954	938	428	42.6	1,800	400	268	92	43	63
Farmers & Farm workers	13.22	3,675	650	750	10.6	2,600	360	500	71	55	67
Heavy workers	6.81	3,025	1,200	750	9.2	2,850	800	394	94	67	53
Extra-heavy workers	1.15	3,240	1,400	850	2.1	3,600	1,000	738	111	71	87
Long or night workers	(5)	(5)	(5)	(5)	7.1	2,250	600	288	-	-	-
Soldiers	3.00	3,800	1,200	520	7.1	4,000	1,400[a]	600	105	117	115
Children[6]											
0-3 years	5.23	782	188	129	5.1	1,100	250	125	141	133	97
3-6 years	4.23	977	375	214	4.1	1,100	250	188	113	67	88
6-10 years	5.90	1,368	657	300	5.8	1,390	400	259	102	61	86
10-14 years	6.36	1,759	844	300	6.3	2,060	400	259	117	47	86
Weighted averages	100.00	2,200	845	460	100.0	2,160	545	332	98	64	72
Excluding soldiers	97.00	2,150	834	458	92.9	2,020	450	307	94	54	67

[1] Estimated on the basis of population and occupational statistics.

[2] Adjustments made for waste & loss of weight in distribution & processing (10% of unadjusted weight.)

[3] Average 1936 and 1937, according to official total consumption statistics.

[4] Roughly estimated by the office of Foreign Agricultural Relations.

[5] Included in "normal consumers".

[6] Pre-war consumption by children, according to age groups, estimated as percentages of "normal" adult's consumption.

[a] June 1 ration of first-line troops.

TABLE VI

Germany: Estimated Wheat and Rye Balance, 1941-42

Supply	1,000 Short Tons	Requirements	1,000 Short Tons
Carryover, August 1941.............	5,400	Seed and waste........................	1,600
1941 Crop, Old Reich...............	13,000	Rations for Old Reich population, all German soldiers, & prisoners of war; & foreign workers..... 9,200	
Imports & Requisitions: 1941-42:		Less 10% for admixtures....... 920	
Danube Countries 750		Net.......................... 8,280	
Western Poland 350	1,100	In terms of grain.........	10,350
		Exports:	
		Austria..........................	500
		Sudetenland & Protectorate........	200
		Alsace, Belgium, Greece, Finland...	800
		Feeding of 1941 breadgrains not usable for human consumption......	1,100
		Carryover, August 1942.............	4,950
	19,500		19,500
Carryover, August 1942	4,950		

TABLE VII

Germany: Estimated Meat Balance, 1941-42

Supply	1,000 Short Tons	Requirements	1,000 Short Tons
Carryover, August 1941	290	Rations for Old Reich population, all German soldiers, prisoners of war and foreign workers	3,375
Domestic Production 1941-42:		Deficit: Austria & Czechoslovakia & other	250
Currently produced from feedstuffs fed in 1941-42	2,500		3,625
Imports & Requisitions 1941-42:		Deficit, August 1942	350
Denmark 225			
Netherlands 40			
Danube Countries 125			
Other Countries 40			
	430		
Supply of fats in sausages & other charcuteries sold as meat	55		
	3,275		3,275
Deficit, August 1942	350		

TABLE VIII

Germany: Estimated Fats and Oils Balance, 1941-42

Supply			1,000 Short Tons	Requirements	1,000 Short Tons
Carryover August 1941			180	Rations for Old Reich population, all German soldiers, and prisoners of war, and foreign workers	1,580
Domestic Production 1941-42			1,000		
Imports & Requisitions 1941-42:				Deficit: Austria, Czechoslovakia & others	120
Lard and fatbacks		50			
Butter:					
Denmark	100				
Other countries	25	125		Supply of fats for sausages and other charcuteries consumed as meat	55
					1,755
Margarine (from imported oilseeds)		25			
Edible oils (olive oil from Italy, Spain, & Turkey)		45		Deficit August 1942	330
			245		
			1,425		1,425
Deficit August 1942			330		

THE GERMAN MINERAL SUPPLY POSITION

A. Survey

December 11, 1941

Coordinator of Information

MINERALS - Survey

THE GERMAN MINERAL SUPPLY POSITION

A. Survey
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THE GERMAN MINERAL SUPPLY POSITION[1]

Summary and Conclusion

Germany before 1939 was notably dependent on imported minerals. From 1933 preparations were undertaken to supply German war industries through a considerable period when foreign resources might be denied. These measures were:

(a) large scale imports, partially for stock-piling

(b) rigid restrictions on civilian consumption

(c) the exploitation of the technical possibilities of ersatz production, notably in oil and rubber

(d) the discovery and exploitation of new German mineral resources, the expansion of existing facilities

(e) the discovery and exploitation of methods for reducing the minimum necessary amounts of steel alloys.

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1. It should, ideally, be the purpose of this study to state quantitatively the present German stock, supply, and consumption positions with respect to strategic raw materials, and to predict therefrom the moment of crisis for these commodities in which consumption exceeds production rate. The data available for such calculations are neither full, consistent, nor reliable. Some such estimates, it is true, are available. The British Ministry of Economic Warfare, for example, predicts that a copper crisis will develop for Germany in the second half of 1942, and that a crisis in chrome will occur early in the spring of 1942. These are drawn from estimates of stocks, production, and consumption that are frankly stated to be subject to a tremendous margin of error. Certain useful conclusions, however, can be drawn with respect to the relative shortage of different commodities. It is clear, for example, that tungsten is a more serious German problem than lead; and that lead is relatively more scarce than zinc. It is, further, likely that, in several cases, German stock-piles are being called upon to maintain current output. Such instances are indicated in the text. But this report as a whole must be regarded as a strictly preliminary statement of the German supply position and its vulnerability.

The German position was materially strengthened by the acquisition of new resources and considerable stocks of strategic minerals in the campaigns of 1940. Deficiencies have, nevertheless, persisted in certain commodities, and the Russian campaign has probably accentuated them. The principal minerals may be grouped as follows:

German Position Secure:

- bauxite and magnesite
- coal and lignite
- iron ore
- manganese ore
- zinc ore
- lead ore
- mercury

German Position Strained but not Critical:

- copper
- phosphates
- antimony
- tin
- coke

With respect to the steel-hardening alloys the German position as a whole is probably serious and potentially critical. They follow, in order of their estimated relative shortage:

- nickel
- tungsten
- molybdenum
- vanadium
- cobalt
- manganese

In the case of the latter three, the German position is relatively secure.

SECRET

THE GERMAN MINERAL SUPPLY

Introduction: In 1934, of thirty-two major industrial minerals Germany produced more than two percent of world output of the following: copper (2%), iron ore (3.4%), lead (4.2%), zinc (9.4%), gypsum (10.3%), coal and lignite (21.3%), potash (61.1%).[1] To these can be added the semi-manufactured products, aluminum (21.8%), pig-iron and ferro-alloys (16.8%). The German industrial machine relied overwhelmingly on imported raw material supplies: domestic non-ferrous metals were sufficient to supply only 27% of the copper, 39% of the lead, 10% of the tin, and 49% of the zinc used in the depressed year 1932.[2]

In the course of 1934 action was taken, under the Four Year Plan, to decrease German dependence on foreign supplies. Action took three forms: elaborate investigations of new domestic sources and substitutes; a search for industrial and mining techniques that increased the productivity of German ore deposits and reduced the requirements of scarce metals in the process of manufacture; and, most important, a program of large scale imports was undertaken, partly for stock-pile purposes. It is, of course, impossible to calculate the amounts of pre-1939 imports that went into reserves. The attached table reveals, however, the scope of the German import program.

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[1] Mineral Raw Materials, 1934, U. S. Bureau of Mines, p. 260. No figure is given in the Bureau of Mines table for magnesite, pyrites, and several lesser minerals. World Production of Raw Materials (Royal Institute of International Affairs, Information Department Papers, No. 18 B), pp. 28 and 41, gives the following percentage figures: for 1937 magnesite (crude), 41.6% (including Austria); for 1938, pyrites, 4%.

[2] Consular Report, Frankfurt, April 18, 1934.

In the period 1933-39 Germany acquired sufficient imported raw materials to construct her military machine and to create large stockpiles. From the early stages of the rearmament period, of course, civilian consumption of strategic commodities was strictly controlled and limited. Further, the following important steps were taken in the direction of substitution and enlargement of domestic capacity:

a. The manufacture of gasoline from lignite, by both the hydrogenation and Fischer-Tropsch processes, was developed on a large scale.[1] In 1936 the eight plants built or under construction had an estimated capacity of 1,060,000 tons per year. Present estimated capacity is 8,000,000 tons annually.

b. Attempts were made to substitute light metals (aluminum and magnesium) for iron, steel, copper, lead and tin. Germany has inexhaustible raw material supplies for the manufacture of magnesium, and counted rightly that adjacent bauxite deposits would not long be denied to her. Plants for the manufacture of light metals were enormously expanded, not only to supply armament materials, but also to meet civilian and other industrial needs by substitution.[1]

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[1] C. W. Wright, "Germany's Capacity to Produce and to Consume Metals, Fuels, and Minerals," Mineral Trade Notes, Nov. 20, 1936, p. 14 and Map no. 4.

c. Extensive research was undertaken on more economical combinations of tungsten, molybdenum, and other imported hardening metals, to achieve appropriate hardness at a lesser raw material cost.[2]

d. In mining operations, new electrical machinery was introduced, and there was a large scale shift to open-cut dredging. This technical combination made possible the more extensive use of inferior continental ores.[3]

e. The manufacture of substitute rubber (buna) was undertaken on a large scale.

The net consequences of these and many similar steps, in conjunction with the import program, was to tide the German controlled area through the period between September 1938 and June 1941, despite the blockade. In that interval, of course, the resources of Poland, France, Norway, Denmark, and the Balkan area became almost exclusively available to German exploitation; Russia supplied limited amounts of strategic materials; and the Transiberian railway brought small but useful supplies of Far Eastern commodities.

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[1] On the general role of light metals in the German economy see "Leichtmetalle in VOrmarsch", Vierjahresplan, March 20, 1941, p. 386. On the substitution of aluminum for tin plate in canning and for iron and steel in barges and small vessels, see Consular Report, Frankfurt, March 21, 1941; in automobile manufacture, Embassy, Berlin, August 4, 1941. For the substitution of aluminum for copper alloys, see C. W. Wright, "Germany's Nonferrous Mineral Industries," Mineral Trade Notes, Sept. 19, 1936, p. 17.

[2] Edouard Houdremont, "Edelstahl in Der Entwicklung," Vierjahresplan, August 5, 1940, pp. 649-52.

[3] In a recent speech (reported from Embassy, Berlin, August 4, 1941) Wilhelm Avieny, member of the board of directors of the Metalgesellschaft told a scientific gathering at Kiel that 90% of the copper ores on the continent, 60% of lead, and 50% of tin were now subjected to the flotation process.

SECRET

Table I

GERMAN IMPORTS OF CERTAIN STRATEGIC MINERALS

	1932	1933	1934	1935	1936	1937	1938	6 mos. 1939
Nickel ore	17,694	34,513	37,609	29,013	17,651	19,990	34,215	15,800
Nickel metal	565	1,968	4,060	5,929	3,392	3,365	3,984	2,164
Chromium ore	42,128	47,370	76,983	95,440	123,375	132,162	176,406	110,131
Copper ore	237,878	240,902	325,921	400,538	482,471	555,577	653,931	336,523
Copper metal	138,100	154,600	182,200	153,365	127,549	169,920	272,400	89,355
Copper scrap	17,527	17,911	14,039	19,891	24,372	32,703	27,308	12,107
Manganese ore	107,000	132,000	223,000	394,256	229,634	554,170	425,785	153,757
Tin ore	1,858	431	602	1,232	1,563	6,623	6,142	2,634
Tin and Tin alloys	9,038	11,281	13,470	11,824	9,176	10,320	12,090	4,768
Tungsten ore	1,615	3,614	4,385	7,681	8,726	11,372	14,200	5,731
Tungsten metal and scrap (incl. chromium and cadmium)	630	1,317	2,877	1,611	4,114	6,605	7,590	4,930
Molybdenum) Uranium) Titanium) Vanadium ores)	2,848	8,945	20,595	27,359	34,512	41,861	64,179	21,365

This table shows import increases of 3 times the 1932 amounts for copper ores, 4 times for manganese ore, 7 times for nickel metal and from 10 to 25 times for tungsten, chromium, molybdenum, titanium, and vanadium ores, needed, for the most part, in the manufacture of special alloy steels.

II

MINERALS IN WHICH GERMAN POSITION IS ADEQUATE

Upon the outbreak of war with Russia, in June 1941, Germany had significantly strengthened its strategic position with respect to minerals. Her status at that time is roughly indicated by the attached table, which also contains estimates for the production of minerals in the Ukraine.[1]

In the following instances German conquests have yielded access to raw materials on a scale adequate to make the Continental war economy potentially self-sufficient.

1. Bauxite. By the close of 1940 the German position with respect to bauxite was sufficient for even the extraordinary requirements of modern war.[2] The major deposits of Hungary, France, and Yugoslavia, supplemented by the lesser supply from Italy, Norway, and possibly from Spain make the raw material for aluminum virtually a surplus in the Greater Reich. In conjunction with raw materials and manufacturing facilities for magnesium, these bauxite, labradorite, clay and other sources serve as the basis for the widespread program of light metal substitution now being pursued by Germany, throughout the Con-

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[1] These calculations represent merely estimated 1940 production rates. Conquest permitted Germany to extend its raw material holdings, as well, by the seizure of stocks and the confiscation of second-hand supplies (e.g., rubber tires, etc.).

[2] See Consular Report, Frankfurt, Dec. 4, 1940.

S E C R E T

ESTIMATED 1940 PRODUCTION OF GERMAN CONTROLLED COUNTRIES*
(In Metric Tons)

Country	Coal 1000 T.	Iron Ore 1000 T.	Pig Iron 1000 T.	Manganese Ore 1000 T.	Chromite	Tungsten 60% WO_3	Nickel	Copper	Zinc	Lead	Antimony	Bauxite 1000 T	Aluminum	Magnesium	Mercury	Molybdenum ore 85%	Petroleum and Substitutes[7] in 1000 bbls.
Germany-Austria	450,000	15,000	22,000				600[6]	36,000	220,000	190,000	180	20	240,000	25,000	65		26,263
Poland	40,000	900	1,000						150,000	22,000							3,891
Belgium-Lux.	30,000	6,000	5,000						20,000	90,000							
France	51,000	35,000	8,000						10,000	42,000		700	50,000	2,000			496
Netherlands	13,000		300					1,000									
Norway	-	1,500	175			20	1,250	20,000	5,000	320			15,000			600	
Sweden	450	14,000	700	6		200		10,000	32,000				1,400				
Finland & Est.	-		30					12,000	1,000								1,000
Czechoslovakia	31,000	2,000	1,200						3,000	4,500	900	1			100		119
Hungary	11,000	400	500	24				400	1,000	200		700	2,800				1,755
Rumania	2,600	130	140	40				600		5,200		40				160	43,231
Bulgaria	3,000	20		1	4,500			400									
Yugoslavia	6,000	600	60	6	60,000			65,000	30,000	10,000	3,350	150	2,800			60	9
Greece	120	300		11	57,000		1,300		3,000	5,000	10	50				300	
Italy	3,000	1,000	1,000	60			200	1,000	100,000	40,000	800	530	40,000	500	2,320	40	1,716
Switzerland	3	180											28,000	700			
Tunisia	-	800							6,000	24,000					10		
Algeria	13	2,800							15,000		800				6		2
Morocco	100	1,600		90		16			1,000		200					280	25
Ukraine		18,000	9,000	1,200													
Portugal[1]						2,500		3,000			130						
German Controlled[2] Countries - Total	641,286	100,230	49,105	1,438	121,500	2.736	3,350	149,400	597,000	433,220	6,370	2,191	380,000	28,200	2,507	1,440	78,507
Stocks Reported Seized in 1940[4]				146 10(ferro-manganese)			(4,000)[6]	65,000 17,000(brass)	31,000[5]	11,000							
World's Output	1,360,000[3]	216,675	113,000	5,250	1,210,000	25.520	130,000	2,290,000	1,800,000	1,750,000	34,000	4,400	800,000	42,500	6,000	21,220	2,259,378
Percent controlled by Germany	47.	46.	44.	27.5	10.	11.	2.5	7.	33.	25.	19.	50.	47.5	66.	42.	7.	3.4

* This table prepared by Mr. C. W. Wright, Bureau of Mines, except where indicated.

(1) The portion of production that probably went to Germany.

(2) To these estimates should be added part of the mineral production of Spain including iron ore, copper, lead, zinc and mercury and of Turkey, including chromite, copper, zinc and antimony.

(3) 1939 production estimate. Only slight change expected in total 1940 coal output.

(4) These figures from MID: Obtained from German Military Attache in Washington, December 17, 1940.

(5) Recent British estimate, 175,000 tons ("Summary of Enemy Economic Developments", BMEW, No. 95, July 7, 1941, p. 154).

(6) The BMEW ("Summary of Enemy Economic Developments", No. 95, July 7, 1941, p. 164) is the source of this figure for nickel stocks seized during 1940 in Norway, France, and other territories; this source also places domestic German nickel production as high as 1000 tons per annum.

(7) An independent estimate of Petroleum products and substitutes produced in German-controlled areas for 1941 is 14.5 million tons, or roughly 108 million bbls.

tinent.[1] It would appear, however, that the manufacturing facilities of the Continent are strained by the demands of the aircraft industry; and that to a limited extent zinc is supplementing the light metals as a substitute especially for copper.[2]

2. Coal and Lignite. Before 1939 Germany was a net exporter of coal. Germany and Austria produced 15.3% of the world's coal output (excluding lignite), in 1938. The very considerable deposits of France (3.8%),[3] Poland (3.1%), Belgium (2.4%),

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[1] The process of expansion in the facilities for light metal manufacture proceeds continuously on the Continent. It is reported reliably, for example, that a new French plant, with a capacity equal to present total French aluminum output (100,000 tons), is scheduled to begin production early in 1943, at Villeyrac, near Montpelier (Summary of Enemy Economic Development, BMEW, no. 98, #47); a large new plant was scheduled to begin manufacture on the island of Usedom, near the mouth of the Oder, in August 1941 (Naval Attache, Berlin, January 10, 1941); an OPM report (through Capt. Reed, Naval liaison officer) states that Germany intends to foster an increase of aluminum production in Norway to a level of 175,000 tons per annum, more than four times estimated current output; but a recent report states that the Norwegian expansion has been held up, due to German unwillingness or inability to deliver alumina ("Summary of Enemy Economic Developments," BMEW, No. 106, Sept. 25, 1941, p. 9); it is estimated that the current production rate at the Lautawerk plant, the largest in Germany, has been increased from thirty six to two hundred sixteen (216) thousand tons per annum (report to MID of Mr. Joseph Matthews, formerly attached to Westinghouse Corporation, in Germany).

[2] Consular Reports, Frankfort, August 2, 1940, and July 26, 1939; for more recent evidence of pressure on the light metal supply, see report from Embassy, Berlin, Aug. 29, 1941.

[3] As late as April 1941, the coal mines of the Lorraine were still reported to be badly flooded and virtually inoperative (New York Times, April 5, 1941); also Consular Report, Frankfort, Feb. 18, 1941.

the Netherlands (1.1%), and Czechoslovakia (1.1%) have insured German industrial invulnerability in this respect, especially if any appreciable proportion of the Russian output can be made available.[1] About two-thirds of Russian output comes from the coal fields in the Donets and Azov-Black Sea Basins, between eighty and ninety million tons annually.[2] On the basis of 1938 percentage figures, these deposits, now threatened by conquest, would add an additional 7% of world output to the German-controlled total. The position with respect to coke is more serious, due to the extraordinary demands of the steel and other metal manufacturing industries.[1] The pressure on the German coke supply can not, however, be regarded as a major shortage.[2] The principal German difficulties with respect to coal and coke arise from a shortage of labor and transport, rather than from a lack of raw material resources.

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[1] It should, however, be pointed out that the German industrial demand, in conjunction with existing transport limitations in Europe, makes the Continental coal-fuel supply seriously inadequate for consumers. Consumers' allowances in the winter of 1940-41 were calculated to have been fully 56% below the previous winter's allotment (Consular Report, Dresden, January 7, 1941). The following further limitation is indicated in a report of the Naval Attache, Berlin, September 30, 1941: "The production of coal in Germany has fallen since June 22, 1941. This may be attributed to the inefficiency of the individual miner who may be communistic, undernourished, overworked, or generally dissatisfied with labor conditions. A goal of 25% increase had been hoped for, but instead a 10% decrease has resulted." Two other factors modify somewhat the general picture of German sufficiency with respect to coal: the bombings of the Ruhr area, which are alleged to have been effective in reducing both coal and iron output (British dispatch, NEW YORK TIMES, March 25, 1941); the sharply increased demand for coal due to the use of inferior grades of ore in the German iron industry (Commercial Attache, Berlin Embassy, Review of 1940).

[2] C. W. Wright, "Mineral Production and Trade of U.S.S.R.," Foreign Minerals Quarterly, June 1938, pp. 48-50.

3. Iron Ore. In 1937 the following areas exported more tham 500,000 tons of iron ore to Germany: Sweden, France, Belgium-Luxemburg, Spanish Morocco, Newfoundland, Algeria, and Norway. Of this array at present the full resources of Newfoundland alone are not at German command. Despite Sweden's quasi-independence, Swedish deposits must be counted a part of the German-controlled area.[3] If the considerable Ukrainian

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[1] Embassy, Berlin, December 20, 1940; also "Notes on the German Iron and Steel Industry," Embassy, Berlin, Feb. 3, 1941.

[2] "Summary of Enemy Economic Developments," B.M.E.W., No. 95, August 7, 1941, page 137.

[3] Deliveries to Germany of Swedish iron ore were reduced in the summer of 1941, as compared to the flow in 1940, due to hostilities in the Baltic. The British estimate that shipments in July 1940 were 1.5 million tons; in July 1941, .9 million tons ("Economic Developments in Enemy Territories to the End of August, 1941", BMEW, September 8, 1941).

resources are included,[1] German-controlled iron ore deposits, comprising (1940) 49% of total annual output, make the Axis position secure.[2] Even without the Russian deposits, however, Germany controls about 40% of world iron ore output: an adequate position.

4. Manganese Ore. In 1937 German manganese supplies came preponderantly from Latin America, from various sections of the British Empire, and from U.S.S.R. Only about 8% of world output (1938) was available in Germany and Austria, while the rest of the Continent yielded but an additional 1.8%. Manganese might have been counted among the vulnerable points in the Germany economy. The occupation, during the summer of 1941, of the Nikopol mines of the Ukraine has, however,

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[1] For a recent German evaluation of the Ukrainian iron ore deposits, see Frankfurter Zeitung, August 16, 1941.

[2] The satisfactory position of Germany with respect to iron ore sources should not be taken as evidence that no significant difficulties exist in the iron and associated industries. There is first, of course, the problem of hardening alloys, discussed separately in this report. In addition the iron industry suffers from a high percentage of inferior ores, requiring extensive coking, with attendant pressures on transport and on coal facilities (Weekly Intelligence Report, ONI, July 25, 1941). The American Iron and Steel Institute estimated that there was, in fact, a decline in steel production in 1940, from 29.6 to 28.2 million tons; and that a sharper fall may be expected in 1941. This analysis counted the Ruhr bombings as a significant factor. The existence of these difficulties is largely confirmed by a report (Military Attache, Berlin, March 3, 1941) on the state of the Hermann Goering Steel Works. This Report discusses the ramifying problems that stem from the use of low-grade ores and points, in addition, to the lack of a satisfactory labor force as a limiting factor. About one half of the 70,000 workers employed in these works are stated to be prisoners of war. See also, "Summary of Enemy Economic Developments," BMEW, No. 95, August 7, 1941, p. 71.

virtually eliminated any danger on this score. The estimated production rate in this area in 1940 (1.2 million tons), if maintained, would make available to Germany a total of 27.5% of world output. The potential supply from the Nikopol ore fields is regarded as virtually inexhaustible.

5. Lead and Zinc Ores. The position of Germany with respect to lead and zinc was never critical. In 1938 Germany and Austria produced 5.4% of the world's lead output, 11.8% of zinc. Supplemented by measures of economy at home[1] and by large imports from abroad, from 1933 to 1939, these supplies were sufficient for the construction of the German war machine.[2] In 1939 the Polish zinc deposits, at Katowitz, came under German control, adding on a 1938 basis 3.7% of world output, on a 1940 basis, about 8%. The zinc resources of Germany are now sufficient to place that metal in the class of potential substitutes. Some efforts have been made, since the acquisition of Polish supplies, to substitute zinc for aluminum, as well as copper, in some civilian uses.[3]

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[1] An aluminum-silicon alloy, containing 87% aluminum and 13% silicon, is said to have been successfully substituted for lead in pigments (Minerals Year Book, 1940, p. 162). An effort is being made, as well, to dispense with the use of lead in storage batteries (idem., p. 135).

[2] The scale of pre-1939 imports is indicated by the figures for 1936. Germany produced in that year 198 thousand tons of zinc ore, imported 121 thousand tons; produced 99.7 thousand tons of lead ore, imported 99.3 thousand tons.

[3] Consular Report, Frankfort, Aug. 2, 1940.

With respect to lead, the position of Germany is less secure than in the case of zinc,[1] but it is probably adequate.[2] The conquest of France (with Tunis and Algeria), Belgium, Poland, Yugoslavia, and Rumania has more than doubled the current ore production available to Germany; although the transport problem must, especially, be taken into account with respect to the French North African output.

6. Mercury. With Spain and Italy within the German orbit, an overwhelming proportion of world output is at her disposal; in 1940 a total of 73% of total world production was under German control.

III

MINERALS IN WHICH GERMAN POSITION IS PROBABLY STRAINED, BUT NOT CRITICAL

With respect to the following raw materials the present German position is probably strained, but not critical.

1. Copper.

It has been recently estimated that Germany's annual consumption of copper runs at about 300,000 tons.[3] As the import table (I) indicates, pre-1939 imports in several years were twice that amount, if copper metal and scrap are added to the ore total. A considerable stock-pile must have been created;[1] and this was obviously necessary in view of Germany's and the Continent's relative lack of copper ores. Germany and Austria yield between 1% and 2% of world output; and the conquest of other Continental areas, notably Yugoslavia, has brought but 8% of the world's ore supply under German control. In addition to stock-piling the following measures have probably prevented the German position from becoming desperate: aluminum, magnesium, and zinc alloys, as well as plastics, have replaced copper in many uses;[2] copper has been restricted, in civilian uses, and much domestic scrap recovered;[3] new mining machinery has permitted the refining of low grade continental ores.[1] These measures have been supplemented by the acquisition of what are believed to have been very considerable stocks in France, Belgium, and Holland (65,000). In the long run Germany's copper resources are not adequate; but copper will probably not represent a critical shortage for some time.[2] The BMEW estimates that the supply is sufficient from all sources, including scrap and stock-pile, until the second half of 1942.

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[1] Naval Attache, Berlin, Sept. 18, 1941

[2] Essential German wartime needs have been recently estimated at 200,000 tons annually ("Summary of Enemy Economic Developments," BMEW No. 95, July 7, 1941, p. 149). The estimated output available in German-controlled areas should meet the requirement without great difficulty.

[3] Minerals Yearbook, 1940, p. 88

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[1] The copper stockpile is estimated to have been 300,000 tons, at the outbreak of hostilities ("Summary of Enemy Economic Developments," BMEW, No. 95, July 7, 1941, p. 144). This source holds that the German copper stockpile in July 1940 was at least as large, due to stocks acquired by conquest in Western Europe. Since July 1940, it is held that copper stocks have steadily decreased, and may be as low as 20,000 tons by the close of 1941; and that a crisis will develop in the second half of 1942, when the possibilities of draining the normal Italian supply, and of using scrap copper will have been exhausted.

[2] Recent reports emphasize, nevertheless, that Germany feels considerable pressure with respect to its copper supply. A Weekly Intelligence Report (Aug. 1, 1941) states that German raiders remove all brass fittings from merchant vessels before sinking them; while a newspaper article (Washington Post, Oct. 28, 1941) alleges that a soft steel is being substituted for copper in shell casings. The Naval Attache at Berlin (Sept. 30, 1941) reports increased interest and discussion concerning the copper resources of the Belgian Congo.

[3] In March 20, 1940, the Embassy in Berlin reported an order by Goering that all bronze bells and copper fittings were to be registered for future delivery.

If Russian copper should become available to Germany, its position would be secure. U.S.S.R. output is currently estimated at 160,000 tons. The present gap between output and consumption is calculated to be only about 120,000 tons.[3] The Russian deposits, however, are still remote from the battle lines: in Russian Mongolia, the Urals, Bashkiria, Transcaucasus, Central Asia, and Western Siberia.[4]

2. Phosphates

At the present time German agriculture is vulnerable, due to a phosphate deficiency in the soil. 1939 was, probably, the last year in which a proper phosphate application was made; and the consequences of this lack are expected, a priori, to be serious for the harvests of 1942. The enormous phosphate deposits of French North Africa are now under German control, pursuant to the terms of the Armistice Agreement. Under optimum conditions these deposits are probably capable of satisfying the total German need. The problem here is one of transport rather than of absolute lack of resources. Phosphates must be moved in closed vessels, rather than barges. And there would appear to be some Axis freighter (or shipping fuel) shortage in the Western Mediterranean, and/or a lack of transport facilities from Southern Europe to Germany, since North African mines are operating far below capacity, at a time when the important American and Russian supplies are denied to the Continent. If Germany can occupy the Kola Peninsula, however, the virtually unlimited apatite resources there are capable, given adequate exploitation and transport facilities, of meeting the German and even continental fertilizer requirements of phosphorus.

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[1] Minerals Yearbook, 1940, p. 111.

[2] The existence of continued pressure on Germany's copper position is, perhaps, indicated by the considerable attention given it in Avieny's speech (reported from Embassy, Berlin, August 4, 1941, see note 6). It is one of the commodities to which German conquests have not contributed significant sources of supply. Avieny devotes considerable attention to potential African copper deposits and their future role in the continental economy. See also "Europe's Metal Basis," Der Wirtschaftsring, Feb. 28, 1941, pp. 2-6.

[3] Minerals Year Book, 1940, p. 88.

[4] C. W. Wright, "Mineral Production and Trade of U.S.S.R.," Foreign Minerals Quarterly, June 1938, p. 32.

3. Tin.

As in the case of copper the German position with respect to tin is unsound in the long run. There are no important tin mines in Europe. The combined Continental production is probably less than 1% of total world output.[1] Germany, however, amassed a large stockpile in the years preceding the outbreak of hostilities, and is believed to have acquired additional stocks in Holland, where Dutch smelters refined the ore from the Netherland East Indies.[1] Some tin was thought to have come to Germany from Japan, in 1940, over the Trans-Siberian Railway. In addition, a vigorous and partially successful program of substitution has been pursued. Germany has developed the BN and other tinless-bearing metals for general use, tin being used only in the high-speed bearings; and in canning foods and packing pharmaceutical products, iron and aluminum substitutes have largely replaced tin. Without knowledge of the tin stockpile it is of course impossible to judge the relative state of Germany's position. It is clear that substitutes have not yet been found for all present uses of tin; and that current tin ore output available to Germany is negligible. The indications are, however, that for the moment immediate tin requirements are being successfully met out of reserves and by substitution.

---

[1] A report from the Embassy, Berlin, January 27, 1941, states that a German scientist claims the discovery of tin in the Sudetenland, to an unspecified amount.

4. Antimony

The acquisition of Jugoslavia, which normally produces about 10% of the world's output of antimony, significantly relieved Germany's position in this respect. Other Continental sources, notably Czechoslovakia and Italy, yield a sufficient output to place Germany's resources at almost 19% of world production. Some stocks of antimony are believed to have fallen into German hands in Belgium.[1] With the uses of antimony strictly controlled, it is likely that military needs, at least, can be satisfied if 1940 continental output figures are maintained.

---

[1] It is estimated (Minerals Yearbook, 1940, p. 685) that 5,600 tons of tin were acquired by the conquest of France and the Netherlands. This is more than half of estimated 1940 consumption (10,000 tons), and more than a third of peak consumption in 1939 (13,774 tons).

IV

CONCLUSION

The minerals thus far examined may be grouped arbitrarily into those in which the German position is secure, so far as resources are concerned, and those in which the German position is strained, but not critical. The conclusions with respect to resources available must be further corrected for transport and labor supply conditions: abundant coal resources will not suffice if the supply of efficient miners can not be maintained; Ukrainian manganese will not fill the present gap, unless it can be transported to German steel plants. A further proviso must be entered with respect to variations within each of the two major groups distinguished here. As the text indicates every mineral represents a unique problem; the type and degree of German self-sufficiency varies strikingly in each instance. The following grouping must, therefore, be regarded as highly arbitrary:

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[1] Minerals Yearbook, 1940, p. 722.

German position secure

1. Bauxite and magnesite: substitute metals, although recent reports emphasize the strain on existing facilities for manufacture.
2. Coal and lignite: adequate raw material supply, although pressure exists on the coke supply. Transport and labor difficulties important.
3. Iron ore: adequate raw material supply, some shortage of high grade ore.
4. Zinc ore: a surplus substitute metal, supplanting copper and the light metals in some uses.
5. Manganese: adequate supply, if Nikopol mines successfully exploited and output transported.
6. Lead ore: a marginal case; probably an adequate supply, under existing conditions of economy and substitution.
7. Mercury: German supply abundant.

German position strained but not critical

1. Copper: evidence seems to indicate much strain, perhaps increasing; but substitute program, plus stocks and civilian economies appear capable of preventing crisis for a considerable time.
2. Phosphates: strained position due to difficulty in making Northwest African supply available to Continent; acquisition of Kola Peninsula would eliminate strain.
3. Tin: undoubtedly a relative shortage exists, but substitutes and stock-pile probably make crisis remote.
4. Antimony: Jugoslavian supply, if made available, probably capable of preventing critical situation from developing.

Among the major minerals there remain the steel hardening alloys and petroleum. In the former, as a group, there appears to be potentially a serious crisis. And they are therefore treated in a separate section, embracing tungsten, molybdenum, chrome, nickel, vanadium, and cobalt. Manganese, in some of its uses, also belongs to this group, although the German position in this respect has been examined above.

Extensive German experiments in substitution make the collective examination of these metals necessary. The rationale for a separate treatment of the German petroleum situation is clear, in view of its unique importance in modern warfare.

Quantitative data on individual minerals are, in most cases so unsatisfactory, it is perhaps worth referring to the view of the German mineral situation taken by contemporary Continental analysts. Their view is, perforce, generally optimistic with respect to Continental self-sufficiency under war conditions; and in many cases that view seems well justified. Without exception, however, they hold that the resources of Russia and/or Africa must supplement the Continent, if stock-piles are not to be depleted. Perhaps the most striking statement is that of Joseph Windsuh, editor of the Deutsche Allgemeine Zeitung, writing on May 14, 1941:[1] "Our ability to continue the war depends not only on Continental reserves and on the productive capacity of Europe, but also on Russia's capacity to supply us. At present we are already using our reserves and we must see to it that they are replaced and enlarged. Everything must be done not to lose the advantage we had at the outbreak of the war."

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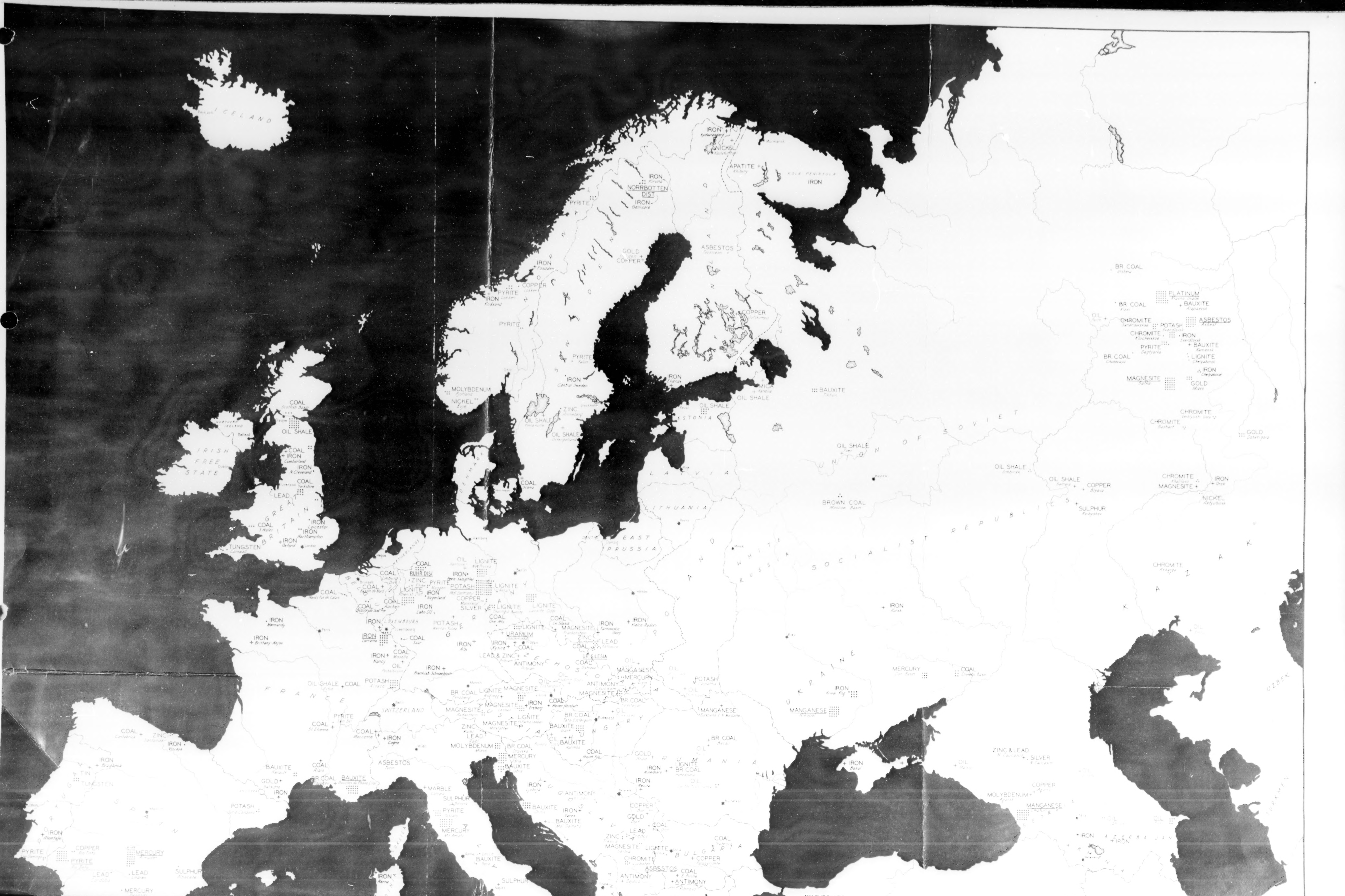
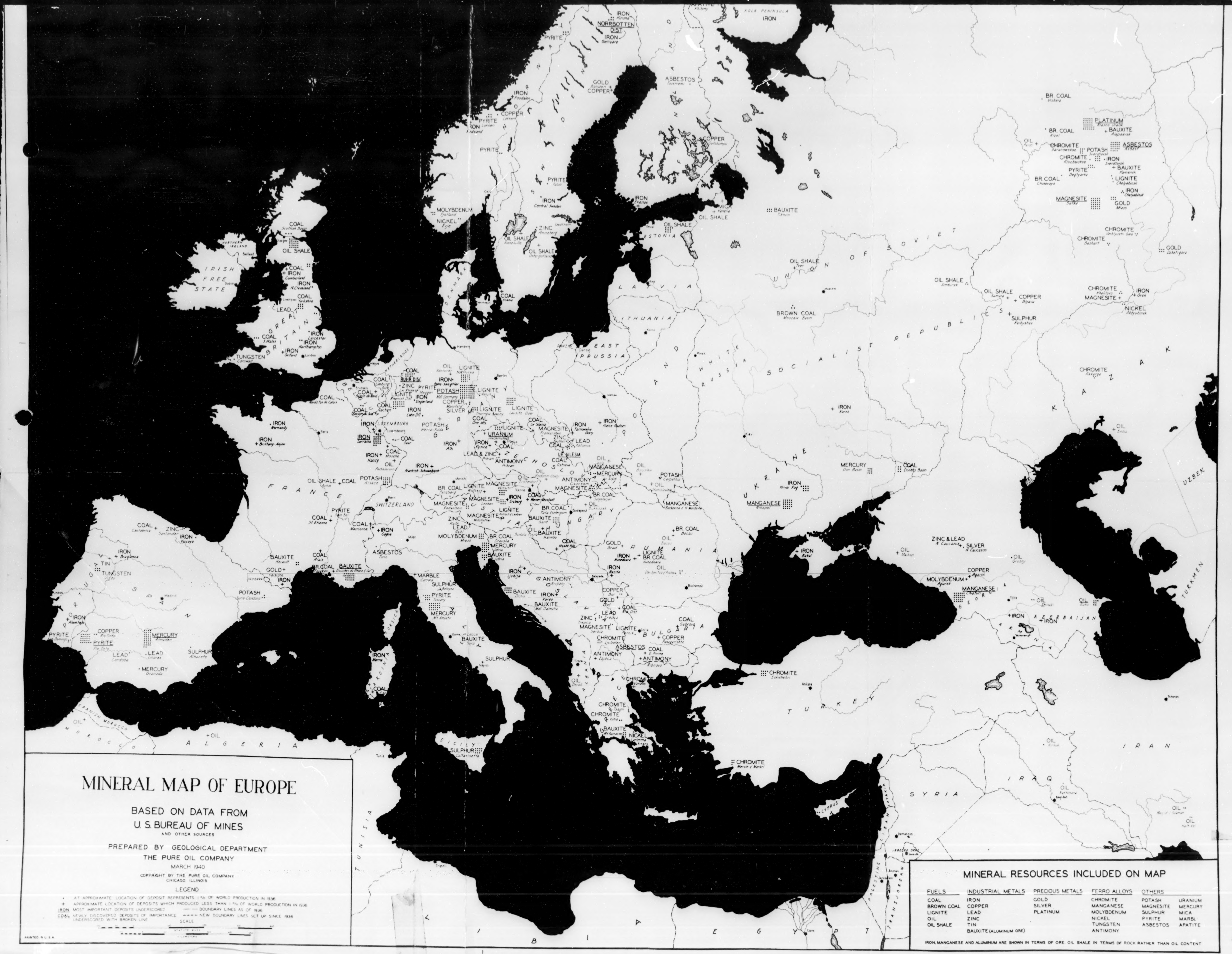
[1] For specific references to the role of Africa as a necessary supplement to the Continental economy, see Herman Baum, "Europe's Metal Basis," Der Wirtschaftsring, February 28, 1941; and an article on "The War Economics of Steel Alloys," in Europa-Kabel, a new Amsterdam economic periodical, August 9, 1941.

If Germany is contained within its present boundaries, there is little doubt that the deficiencies of the Continent will assert themselves in the long run. The acquisition of large stocks by conquest, in 1940, undoubtedly gave an unnatural and temporary security to the German position, in certain respects. It must, of course, be remembered, however, that complete victory in Russia and a thorough exploitation by Germany of Northwest and West Africa is capable of making the Continent permanently self-sufficient; and that the long-run deficiencies may never assert themselves decisively in this war.


ICELAND
IRISH FREE STATE
GREAT BRITAIN
FRANCE
SWITZERLAND
LUXEMBOURG
ESTONIA
LATVIA
LITHUANIA
EAST PRUSSIA
WHITE RUSSIA
UKRAINE
UNION OF SOVIET SOCIALIST REPUBLICS
KAZAK
UZBEK
RUMANIA
BULGARIA
KOLA PENINSULA
NORRBOTTEN DIST
RUHR DIST
SILESIA
IRON
NICKEL
APATITE
PYRITE
ASBESTOS
GOLD
COPPER
MOLYBDENUM
ZINC
OIL SHALE
COAL
LEAD
TUNGSTEN
OIL
LIGNITE
POTASH
SILVER
URANIUM
LEAD & ZINC
ANTIMONY
MAGNESITE
MANGANESE
MERCURY
BR COAL
BAUXITE
BROWN COAL
SULPHUR
PLATINUM
CHROMITE
ZINC & LEAD
MARBLE
TIN
MERCURY
CHROMITE


IRISH FREE STATE
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COAL
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GOLD
ASBESTOS
KOLA PENINSULA
APATITE
MOLYBDENUM
NICKEL
ZINC
OIL SHALE
MICA
BAUXITE
ESTONIA
LATVIA
LITHUANIA
EAST PRUSSIA
POLAND
WHITE RUSSIA
UKRAINE
UNION OF SOVIET SOCIALIST REPUBLICS
KAZAK
UZBEK
TURKMEN
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RUHR DIST
POTASH
URANIUM
SILVER
LIGNITE
ANTIMONY
LEAD & ZINC
UP. SILESIA
CZECHOSLOVAKIA
HUNGARY
RUMANIA
YUGOSLAVIA
BULGARIA
ALBANIA
GREECE
CHROMITE
MARBLE
SULPHUR
MERCURY
BAUXITE
PORTUGAL
SPAIN
TIN
PYRITE
COPPER
ZINC & LEAD
SILVER
GEORGIA
ARMENIA
AZERBAIJAN
TURKEY
IRAN
IRAQ
SYRIA
CYPRUS
PALESTINE
TRANSJORDAN
SICILY
SARDINIA
SPANISH MOROCCO
MOROCCO
ALGERIA
TUNISIA
LIBIA
EGYPT
OIL

MINERAL MAP OF EUROPE

BASED ON DATA FROM
U. S. BUREAU OF MINES
AND OTHER SOURCES

PREPARED BY GEOLOGICAL DEPARTMENT
THE PURE OIL COMPANY
MARCH 1940

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CHICAGO, ILLINOIS

LEGEND

- • AT APPROXIMATE LOCATION OF DEPOSIT REPRESENTS 1 % OF WORLD PRODUCTION IN 1936
- + APPROXIMATE LOCATION OF DEPOSITS WHICH PRODUCED LESS THAN 1 % OF WORLD PRODUCTION IN 1936
- IRON MOST IMPORTANT DEPOSITS UNDERSCORED
- COAL NEWLY DISCOVERED DEPOSITS OF IMPORTANCE UNDERSCORED WITH BROKEN LINE
- —·— BOUNDARY LINES AS OF 1936
- - - - NEW BOUNDARY LINES SET UP SINCE 1936

SCALE

STATUTE MILES

KILOMETERS

PRINTED IN U. S. A.

MINERAL RESOURCES INCLUDED ON MAP

FUELS	INDUSTRIAL METALS	PRECIOUS METALS	FERRO ALLOYS	OTHERS	
COAL	IRON	GOLD	CHROMITE	POTASH	URANIUM
BROWN COAL	COPPER	SILVER	MANGANESE	MAGNESITE	MERCURY
LIGNITE	LEAD	PLATINUM	MOLYBDENUM	SULPHUR	MICA
OIL	ZINC		NICKEL	PYRITE	MARBL
OIL SHALE	TIN		TUNGSTEN	ASBESTOS	APATITE
	BAUXITE (ALUMINUM ORE)		ANTIMONY		

IRON, MANGANESE AND ALUMINUM ARE SHOWN IN TERMS OF ORE. OIL SHALE IN TERMS OF ROCK RATHER THAN OIL CONTENT

SECRET

THE GERMAN MINERAL SUPPLY POSITION

B. The Steel-Hardening Alloys

December 11, 1941

Coordinator of Information

SECRET

THE GERMAN MINERAL SUPPLY POSITION

B. The Steel-Hardening Alloys

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SECRET

The Steel-Hardening Alloys: Tungsten, Molybdenum, Nickel, Chrome, Cobalt, Vanadium, and Manganese[1]

Summary and Conclusion

The manufacture of the materiel of modern warfare makes extraordinary demands on the steel-hardening alloys. Before 1939 Germany was self-sufficient in none of the major hardening alloys. In the interval between 1933 and 1939 imports proceeded on an enormous scale, and large stockpiles were undoubtedly created. In addition, efforts were made to reduce the amount of hardening minerals required in the steel industry, and to discover means of substituting molybdenum and manganese, the more available alloys, for the others, notably nickel and tungsten. Finally, apparently successful methods were discovered for extracting vanadium from domestically yielded by-products.

The present German position with respect to each of the alloys may be briefly summarized as follows:

tungsten: Portuguese output being expanded and going increasingly to Germany. Despite this development and extensive substitutions of molybdenum, the German stockpile is probably being reduced, since the Russian war cut off the Chinese supply.

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[1] Germany has recently exhibited an increased interest in beryllium stocks held in Portugal. The known conventional use for beryllium is in copper alloys. It is possible, however, that beryllium is being used as a supplementary steel alloy, for limited purposes.

molybdenum: Yugoslavia, Norway, French Morocco and other areas probably yield about 15% of world output to Germany. Extreme efforts being made to expand Continental output. Stock-pile position probably better than for tungsten, but being slowly reduced.

nickel: Perhaps most serious of all alloy shortages. Stock-pile probably being reduced quickly. Limited crisis may develop unless Petsamo mines can be set to work in Finland. This seems unlikely in near future.

chrome: Conflicting evidence on amount of Balkan supply coming to Germany. Stock-pile probably being reduced, although full exploitation of Balkan resources might check trend.

cobalt: Necessary for both steel and hydrogenation. French Morocco only major source of supply. Probably sufficient if freely exploited and transport made available.

vanadium: Probably sufficient supply to be drawn from steel slag and burnt oil residue.

manganese: Ample supply, if Nikopol production successfully mined and transported from Ukraine.

Without a knowledge of the German stockpiles at the outbreak of hostilities, of current consumption rates, and of the overall savings effected by technology no accurate judgment of Germany's present position can be made. Some German commentators have expressed confidence that Germany's position is secure with respect to steel-hardening alloys, even in the face of a long war. On the other hand, the extreme measures taken by Germany in Portugal, her severe pressure on Turkey for its chrome supply, the efforts being made to discover new molybdenum deposits on the Continent indicate a considerable strain. Despite economies and substitutions, it is likely that Germany is consuming tungsten, nickel, chrome and possibly molybdenum at a greater rate than current imports allow; and that her stockpiles are being depleted. The evidence required to predict the moment of crisis in respect to these alloys is not available.

I. Steel-hardening Alloys in the German War Economy, 1932-39

A. Uses

Steel-hardening alloys have been, to a greater or less degree, indispensable in the following uses: (1) Airplane crankshafts and other fast-moving parts, (2) high-speed steel, (3) tips for cutting tools, (4) hard dies, (5) armor piercing bullets, (6) erosion resistant gun barrels for heavy ordnance, armor plate, and gun breeches.

B. Substitutes

As a steel hardening alloy tungsten has proved, to some extent, replaceable by molybdenum, especially in combination with cobalt, chrome,manganese, vanadium and other rare metals (beryllium, circon, tellurium, tantalum, etc.). German technicians, further, have devoted considerable research to the problem of reducing the minimum requirements of tungsten and other hardening alloys in the production of hard steel.

C. German Supply Position

Before 1939 Germany relied on imported supplies of steel hardening alloys. Normal American consumption of tungsten is about 5,000 tons per year; German peacetime imports averaged 3,494 tons between 1923 and 1928. Her requirements are difficult to estimate at present; but in 1918 America consumed 15,731 tons of tungsten. O.P.M. currently estimates 1941 consumption in the United States at 18,000 tons, that for 1942, at 25,000 tons.

As in the case of other strategic imports, Germany created a considerable stock-pile between 1933 and the outbreak of hostilities. German imports in metric tons of tungsten and associated metals follows:

S E C R E T

Imports	1932	1933	1934	1935	1936	1937	1938	1939 6 mos.
Tungsten ore (60% WO_3)	1,615	3,614	4.385	7,881	8,726	11,372	14,200	6,738
Tungsten metal*	630	1,317	2,877	1,611	4,114	6,605	7,590	4,930
World Production								
Tungsten ore (60% WO_3)	6,800	12,400	16,447	22,458	24,746	37,840	33,449	27,600
Imports								
Nickel ore	17,694	34,513	37,609	29,013	17.651	19.990	34,215	15,800
Nickel metal	565	1.968	4,060	5,929	3,392	3.365	3,084	2.164
Chromium ore	42,128	47,370	76,983	95.440	123.375	132,162	176.406	110,131
Manganese ore	10,700	132,000	223,000	394,256	229,634	554,170	425,785	153.757
Molydenum) Uranium) Titanium) Vanadium) ores)	2,848	8,945	20,595	27,359	34,512	41,861	64,179	21,365

*Including some cadmium and chrome in scrap.

German imports of tungsten ore and metal rose from 25% of total world output to almost 66%. The import of tungsten ore was about equally divided between China and British India with only small amounts drawn from Bolivia and other areas. Although it is evident that a considerable stockpile for tungsten and other steel-hardening metals was created, it cannot be calculated.

II. Steel-hardening Alloys in the German War Economy, September 1939-November 1941

German devices for maintaining an adequate supply of tungsten and other steel-hardening metals under wartime conditions have been the following: (a) Imports from sources still available, (b) the enlargement of productive capacity in areas under German control, (c) further economy in the use of steel-hardening alloys.

A. Current Imports

Germany's position with respect to supplies in 1940 of tungsten, chromite, nickel and molybdenum are indicated in the attached table. With respect to tungsten, it is clear that Portugal is the only significant Continental supply source. In 1940 large amounts are alleged to have come to Germany from China across the

ESTIMATED 1940 PRODUCTION OF GERMAN CONTROLLED COUNTRIES[1]

(In Metric Tons)

Country	Tungsten 60% WO_3	Molybdenum ore	Chromite (Crude ore)	Nickel
Germany-Austria				600
Norway	20	600		1,250
Sweden	200			
Rumania		160		
Bulgaria			4,500	
Yugoslavia		60	60,000	
Greece		1,600	57,000	1,300
Italy		40		200
Morocco	160	280		
Portugal[2]	2,500			
German Controlled Countries - Total	2,880	2,740	121,500	3,350
World Output	25,520	18,220	1,210,000	130,000
Per cent Controlled by Germany	11	15	10	2.5

Note. The Moroccan cobalt supply, now available under restricted political and transport conditions to Germany, is normally about 700 tons (metal), or between 25 and 30% of world output. Other available output, in Finland and Germany, may yield an additional 300 tons.

1. This table prepared by Mr. C. W. Wright, Bureau of Mines

2. The portion of production that probably went to Germany

Trans-Siberian railway.[1] The denial of this route was the principal consequence of the Russian-German war on the supply position with respect to steel-hardening alloys.

B. The Enlargement of Continental Productive Capacity.

The denial of Chinese tungsten ore to the German economy has caused an intensification of efforts to increase Continental output of steel-hardening alloys.

1. The Portuguese wolframite supply is the most important Continental source of tungsten. Britain and Germany have bid the Portuguese price to new high levels[2] and called forth a substantial increase in

---

[1] The American Military Attache at Berlin reported on March 3, 1941 that fully 15,000 tons of tungsten ore had come via Russia from China in the course of an unspecified period, since the outbreak of war. This large amount seems unlikely. A British report of July 11, 1941 states that 899 metric tons of tungsten passed over the Trans-Siberian Railway in 1940, 188 tons in the first five months of 1941. Other reports refer to plans for shipment of tungsten from Bolivia, to be sent to Peru, and shipped from there, and transferred later to German submarines. Whether Germany actually obtained any tungsten in this manner is not known. Another report indicates that tungsten was being shipped to Germany in Japanese ships via Vladivostok before June 22, 1941.

[2] The world market price for tungsten ore is $105 per ton. A British source states that the current Portuguese price is L2,250 per ton (letter from Captain F. C. Goodwin, British consul, in Oporto to Mr. Thurman Arnold); while an American source (Mr. W. C. Clayton) gives the current Portuguese price at fully $15,000 per ton.

output there. It was believed for some time that Germany and Britain were roughly sharing the Portuguese output, but latest advices are that Germany is now getting more than half of Portuguese production.

According to Captain Goodwin's estimate Germany will be getting tungsten ore from Portugal at an annual rate of from 3,500 to 5,000 tons by Christmas 1941. The Germans have taken the following steps: (a) They commissioned agents to pay very high wages to Portuguese peasants, estimated in the tens of thousands, to exploit the surface mines.[1] (b) German agents have purchased a considerable number of old Portuguese mines and expanded their output; they have also discovered a number of new mines.[1]

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[1] Peasants whose normal daily earnings were not more than 7 escudos are now alleged to earn about 100 escudos a day picking wolframite ore from the hills of northern Portugal. This movement has been on a scale sufficient to cause a perceptible shortage of agricultural labor in Portugal.

2. Other Continental tungsten sources.

(a) Important new tungsten ore deposits (scheelite) are alleged to have been discovered in the Bergslagen district near Grangesberg, Sweden, said to be large enough to supply all of Sweden's tungsten needs.[1]

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[1] On August 20, 1941, Mr. Fish of the American Legation in Lisbon reported the purchase by Germans of four Portuguese-ownod tungsten mines at the excessive price of 31,000 contos (approximately $1,240,000); Mr. Fish reported, as well, that the Germans had opened negotiations with M. Grammont, director of the French-owned Borralha mines, for the purchase of these mines, and that the British were attempting to hold up this purchase by legal action. On September 26, 1941 Ambassador Leahy reported from Vichy that the suggestion was put forward by the Vichy authorities to M. Grammont that upon the latter's return to Lisbon he make an effort to have the German and British authorities accept an arrangement whereby there would be available to the Germans 10 per cent of ordinary wolfram output of the Borralha mines, and 10 per cent of ordinary quality wolfram. A dummy Portuguese company would hold the remainder of Borralha's output. This Portuguese company would then let the British and American interests have the output it controlled. According to the American Embassy's informant, the mines would otherwise have to close down due to lack of fuel and legal obstacles put in its way by the British. The upshot of this proposal is not known.

Captain Goodwin states that the Empresa Mineira de Sabrosa, now owned by Germans, produced 4-5 tons a month a year ago; in June of 1941 it was 12.5 tons, and this is to be increased to 25 tons by Christmas of 1941. This has been due wholly to one Herr Dietmar, German agent in Portugal, who has produced the capital and guaranteed both plant and stores. So far, 18 concessions and numerous mining claims have been brought into the German organization mentioned above. Dietmar finally induced the able Portuguese administrator to remain in charge of the new organization. Dietmar has also obtained an option to purchase another group in the same district where production could be brought up to 50 tons per month.

(b) Two Spanish wolfram mines at Pastoriga and Paquita which have been surveyed by the German technicians but temporarily rejected as being in poor condition.

3. Molybdenum

Greece and Norway are the principal Continental sources of molybdenum, the former only recently developed as a major source of supply.[2] Efforts are being made to expand output in these areas; while Germany is reported looking, as well, in the direction of new veins in the Vosges (France), Sweden (in the vicinity of Lillhard), and in the Atlas Mountains (French Morocco). Japanese agents, operating with German assistance, are reported to have investigated deposits of molybdenum ore in Bolivia, prefecture Pa Paz, believed capable of producing 50 tons a month. There is no evidence available on the size of the molybdenum stockpile; and the combination of economies and expanded uses which have occurred in this case makes speculation as to the probable consumption rate impossible. It is probable, however, that the present German position with respect to molybdenum is fairly satisfactory.

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[1] This and other items relevant to new Continental sources of supply for tungsten and other steel-hardening alloys are to be found in an article in Der Wirtschaftsring of February 28, 1941. This article has been translated under the title "Europe's Metal Bases" and is in the files of O.N.I.

[2] Minerals Yearbook, 1940, p. 614

4. Chrome

The extreme diplomatic pressure exerted recently by Germany on Turkey in connection with the latter's exports of chrome indicate roughly the pressure of current requirements on available German chrome sources.[1] Until the successful consumation of the Balkan campaign Germany had no chromite ore under its direct political control. Bulgaria, Jugoslavia, and Greece produce about 10% of total world output, and that supply is now, of course, at German command.[1] In addition, the German-Turkish agreement of July 25, 1940, involved relatively small chromite shipments, and until June, 1941, Russia is believed to have been shipping some chrome to Germany.[2] The evidence of the Import Table (1), is clearly that large stockpiles had been amassed between 1932 and the outbreak of war. Recent research in hard steel has resulted in a considerable reduction in the unit industrial requirement of chrome;[3] and in conjunction with stockpiles and the current Balkan output, these economies should prevent a drastic chrome shortage in Germany for some time. Recent reports state, however, that Turkish ores are still required, in German industry, since the yield from Greece and Yugoslavia is both insufficient and of poor quality,[1] and the BMEW expects a crisis in chrome as early as the spring of 1942. This is a distinctly optimistic estimate, if 1940 output figures, as given by the Bureau of Mines, should be maintained. In January 1943, the Turkish ore will again be available to Germany, should the conditions affecting the recent treaty remain unchanged in the coming year.

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[1] The Military Attache at Berne reported on Sept. 11, 1941, the statement of a Polish Military Attache that German shortages of chromium, copper, and molybdenum had already caused a reduction in the output of cannon tubes.

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[1] It has been recently reported that sabotage at the Allatini Chromite properties in Jugoslavia has temporarily reduced output there. ("Summary of Enemy Economic Developments", No. 96, July 7, 1941, p. 176). This source puts total chromite shipments available to Germany from the Balkans at only 2,000 tons per month (chromic oxide content). German annual requirements are held to be 40,000 tons annually. At the outbreak of hostilities, German stocks are estimated to have been 97,000 tons of chromite ore, 18,500 tons of ferro-chrome; in September 1941, 12,000 tons of ore, 8,500 tons of ferro-chrome, or some equivalent combination of these. The stock is, therefore, held to be sufficient only until the spring of 1942, by the BMEW.

[2] Embassy, Berlin, August 19, 1941.

[3] E. Houdremont, op. cit., pp. 650-51.

5. Nickel

In his Annual Economic Review for 1940 the American Commercial Attache at Berlin wrote:[2] "The position in regard to nickel seems to have been most serious of all, although it was claimed that certain stocks of this strategic metal were accumulated before the outbreak of hostilities. The Finnish Petsamo nickel mines are not likely to start normal operations before the end of 1941 or early in 1942." The resumption of Russian-Finnish hostilities has probably postponed for a considerable time the moment when a useful supply of Petsamo nickel will be available to Germany. It is unlikely that a significant supply will be forthcoming from this source in the coming year. Germany is being forced, therefore, into continued reliance on: (a) the most thorough exploitation of Continental sources; (b) a stockpile created out of pre-war imports; (c) economies achieved by new technological investigations; (d) rigid limitation on non-essential uses, combined with the withdrawal of nickel coins, fittings, etc.

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[1] Naval Attache, Berlin, Sept. 4, 1941.

[2] Page, 23.

German nickel imports, between 1932 and July 1939 follow:

	1932	1933	1934	1935	1936	1937	1938	1939
Nickel ore	17,694	34,513	37,609	29,013	17,651	19,990	34,215	15,800
Nickel metal	565	1,968	4,060	5,929	3,392	3,365	3,984	2,164

Pre-war sources of nickel, and the amounts imported from them by Germany in 1937, follow: (in tons)

Canada	13,250
Br. India	3,594
Brazil	2,032
Fr. Morocco	659
Others	455
	19,990

Sources available to Germany in 1940 are estimated as follows: (in tons)

Norway	1,250
Greece	1,300
Germany and Austria	600
Italy	200
	3,350

At the close of 1940 it is estimated that Germany had a stock of nickel at its command of somewhat less than 17,000 tons.[1] This rough figure was arrived at by adding to the estimated pre-war stock-pile (2500 tons) for nickel recovered from the German coinage, and about 4,000 tons believed acquired in Norway, France and other occupied territories in 1940. It is impossible to estimate the rate at which nickel is now being consumed in Germany. The minimum peacetime requirement stood at about 10,000 tons per annum. The manufacture of modern war materiel makes extreme demands on nickel, especially because of its weather resistant properties. On the other hand, domestic conservation has been pushed to extreme degrees. Not only have nickel coins throughout the Continent been called in, and civilian nickel uses been virtually eliminated but, as well, chrome-molybdenum steels have been substituted in many cases for chrome-nickel steels.[1] Even in the manufacture of dairy machinery the traditional rust-resistant nickel has been largely foregone.[2] Despite these strenuous efforts at economy and substitution, it does not seem excessive to place the German minimum requirement for nickel somewhat above 10,000 tons annually. Continental production is, clearly, incapable of meeting this rate of consumption. If the British stock-pile figure given above is correct, and if it is assumed that the full Continental nickel supply, at 1940 production rates, will go to Germany, the position of

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[1] "Summary of Enemy Economic Developments", B.M.E.W. No. 95, July 7, 1941, P. 164

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[1] Embassy, Berlin, March 5, 1941. This source states that German scientists have discovered that the addition of .15% nitrogen is capable of saving as much as 3-4% of nickel. It was pointed out that a combination of chrome, manganese, and silicon is being used in heat resistant steels, where nickel had previously been thought indispensable. In addition, to some extent, manganese has proved an adequate substitute for nickel; and with the Nikopol mines under German control, this type of substitution will, undoubtedly, be pushed to the limit. (Herman Baum, op. cit., p. 9).

[2] Consular Report, Cologne, November 18, 1940.

Germany by the latter months of 1942 may well be critical with respect to this commodity.

6. Cobalt

Cobalt is employed in the German war economy as a metal, in the manufacture of special steels, as a binder for sintered carbides, and as a catalyst in the production of petroleum by the Fischer-Tropsch process. It is estimated that the minimum consumption requirement is between 600 and 700 tons per annum.[1] This figure includes some 200 tons believed necessary to replace the cobalt elements installed in the hydrogenation plants.[2] The major world producers of cobalt and the metallic content of ores produced in 1938 follow:[3]

World Cobalt Production (Metal Content)

Northern Rhodesia	1,502	metric tons
French Morocco	720	" "
Burma	238	" "
Canada (Ontario)	208	" "

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[1] "Summary of Enemy Economic Developments", BMEW No. 95 July 7, 1941, p. 168.

[2] This assumes a 5% annual replacement rate, since 4,000 tons of cobalt was believed installed in German oil refineries at the outbreak of the war.

[3] Minerals Yearbook, 1940, p. 608.

The British estimate that Germany can extract about 160 tons of metal per annum from domestic ores located in the Harz Mountains, and that Finland normally produces about 200 tons, some of which is delivered to Sweden.[1] It is clear, therefore, that the French North African supply is crucial to the maintenance of the German cobalt position. The American Military Attache in London reported on November 8, 1941 that Vichy had consented to ship in the near future 500 tons of cobalt ore from Morocco; and that previous shipments of 300 tons and of 100 tons were known to have taken place recently. If Germany can ensure that Moroccan cobalt is mined and transported, her current requirements can probably be met for an indefinite period.

7. Vanadium

The production of vanadium from blast furnace slag is believed to be sufficient for German needs.[2] This is supplemented by the Italian vanadium supply, drained from the soot of oil-burning ship and factory engines.[1]

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[1] A recent British report states that Italy is now attempting to acquire Finnish cobalt from Sweden ("Summary of Enemy Economic Developments," BMEW No. 105, Sept. 17, 1941, p. 17.)

[2] Consular Report, Frankfort, August 2, 1940.

8. Manganese

With the acquisition of the Nikopol deposits in the Ukraine the German position with respect to manganese seems tobe secure for an indefinite period.

C. Further Economy in the Use of Steel Hardening Alloys.

In an article in Der Vierjahresplan, August 5, 1940 Eduard Houdremont analyzed in detail Germany's position with respect to special steels. The conclusions of this article are the following: (1) that in recent years the German steel industry has made great progress in producing hard steels either without alloys or with a very low alloy content (see supporting article by H. Kiessler in Stahl und Eisen, May 22, 1941);[2] (2) that the German government (Reichsstelle fur Stahl und Eisen) in close cooperation with the army and the steel industry, has made possible a substantial reduction in the consumption of strategical minerals without reducing either the quality or quantity in the production of hard steels; (3) that German metallurgical chemists have achieved new combinations of hardening alloys, which allow substantial savings in strategic minerals, without appreciable loss in efficiency.[1]

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[1] Herman Baum, op. cit., p. 12

[2] In the Monthly Review for August, 1941, p. 5 (dated Sept. 29, 1941) the Berlin Embassy reports continued research in the use of oxygen and nitrogen as steel-hardeners, in order to replace the familiar alloys. This would substantiate our view of pressure on the alloys as a whole, despite economies and substitutions among them.

III. Conclusion.

Without a knowledge of the German stock-pile at the outbreak of hostilities, of current consumption rates, and

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[1] Houdremont contends that whereas in 1925 high speed cutting steel required 0.85% cobalt - 4.2% chromium - 20% tungsten - 0.8% molybdenum - 1.5% vanadium, and even better cutting steel could be produced since 1937 with 0.7% cobalt - 4.2% chromium - 2.0% tungsten, 8.0% molybdenum - 1.0% vanadium. It should be noted that the increase in molybdenum is less than the decrease in tungsten. The percentage of hardening alloys used in 1925 was 27.35, from 1937 on, 15.90. Even more drastic savings are indicated in the following figures for the consumption of nickel and other scarce materials in the Robert Bosch electrical supply works: (in Kilograms).

	1938	1939
Nickel	33,800	100
Copper	163,500	20,700
Various brasses	1,057,000	283,200
Silver	1,700	400
Tin	9,900	8,200
Lead	306,200	275,200
Rubber	213,500	42,900

("Summary of Enemy Economic Developments", No. 105, Sept. 17, 1941, p. 12) of the over-all savings effected by technology no accurate judgment of Germany's present position can be made. Some German commentators have expressed confidence that Germany's position is secure with respect to steel hardening alloys, even in the face of a long war. On the other hand, the extreme measures taken by Germany in Portugal, her severe pressure on Turkey for its chrome supply, and the efforts being made to discover new molybdenum deposits on the Continent indicate a considerable strain. Despite economies and substitutions, it is likely that Germany is consuming tungsten, nickel, chrome, and possibly molybdenum at a greater rate than current imports allow; and that her stockpile is being depleted. The evidence required to predict the moment of crisis in respect to these alloys is not available.

THE GERMAN MINERAL SUPPLY POSITION

C. Petroleum

December 11, 1941

Coordinator of Information

SECRET

THE GERMAN MINERAL POSITION

C. Petroleum

Page

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Chart 1 Axis Crude Production
Chart 2 Rumanian Crude Production

Table 1 Axis Europe Crude Production
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Table 3 Military Consumption
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C. THE GERMAN PETROLEUM POSITION

I

SUMMARY AND CONCLUSIONS

1. To ensure an adequate petroleum supply in case of a major war has been a prime objective of German policy since 1933. Between 1933 and 1939 the following types of action were pursued:

   a. Large stocks were accumulated from abroad.

   b. The domestic output of crude oil was sharply increased.

   c. Large plant facilities were provided for the manufacture of synthetic petroleum products.

   d. Less essential uses were curtailed.

The acquisition through conquest of the prime oil producing areas of Europe has probably constituted a net accretion to Germany's petroleum supply; although that accretion was limited by the simultaneous acquisition of responsibility for satisfying the minimum petroleum needs of Italy and the occupied areas.

2. The various estimates available of the present production and consumption rates in occupied Europe, and of the stocks of petroleum available to Germany are sharply at variance, and the following conclusions, therefore, must be regarded as highly tentative:

   a. With the completion of the Western campaign in 1940 and with the Continent-wide application of stringent economies, it would appear that the relation between consumption and production was such as to permit at least a balance, at a level of 14-16 million tons annually, and probably some accretion to stocks.

b. This relatively secure situation, however, depended not only on severe industrial and civilian restrictions, together with the widespread use of substitute fuels, but also upon the fact that the German armies were not used actively and on a large scale in the year following June 1940.

c. Within the rough equilibrium or surplus that appears to have existed, there were shortages of particular products, notably Diesel fuel and lubricants; and some surplus, under existing economies, of certain types of gasoline.

3. The Russian campaign has altered this situation in the following respects:

a. Total consumption of petroleum has undoubtedly increased substantially, despite further curtailment in less essential uses.

b. Difficulties of oil transport from Rumania to Germany, which had inhibited the effectiveness of this area as a source of supply, are reported to be somewhat alleviated; and it has proved possible to send Rumanian oil directly North and East, to the Axis armies in the field.

c. Russian petroleum supplies, previously available at the rate of about a million tons a year, have been cut off, and are only partially offset by the acquisition of the Galician production.

d. Heavier R.A.F. bombings have probably impaired the operating efficiency of refineries and synthetic plants in Western Europe and destroyed some oil stocks.

Almost all estimates of current consumption indicate that Germany is at present maintaining its war machine partly out of petroleum stocks, accumulated before June 1941. Estimates of the rate at which depletion is proceeding vary; the extreme calculations, indicate that the present rate, if maintained, would exhaust German petroleum resources within the next calendar year.

4. The following factors make complete exhaustion unlikely within the next year:

a. More moderate estimates of consumption suggest that the drain on stocks is at present less than 10% per year.

b. The intensity of warfare, and therefore the oil consumption rate, will probably not remain steadily at its present level.

c. It is possible that Germany will gain control of the fairly accessible oil fields of the Northern Caucasus. In that case, substantial quantities of oil will probably be obtained, regardless of Russian sabotage and the difficulties of transport.

d. There is still a small margin by which civilian consumption can be reduced; and the possibility of using producer and bottle gas equipment in motor vehicles and other industrial and commercial uses has not been fully exploited.

e. New synthetic oil plants may be brought into production.

f. The Rumanian oil fields may be exploited more fully.

5. On the basis of present evidence, therefore, it cannot be predicted that Germany will suffer a critical petroleum shortage in 1942.

II

THE SOURCES OF SUPPLY

A. Crude Oil Production

Typical of Western Europe as a whole, Germany in the early days of the Third Reich produced approximately one quarter of its total peacetime petroleum requirements. From 1933 the utmost effort was made to decrease Germany's dependence on extra-Continental supplies (1) by increasing the production of domestic crude, (2) by greatly expanding

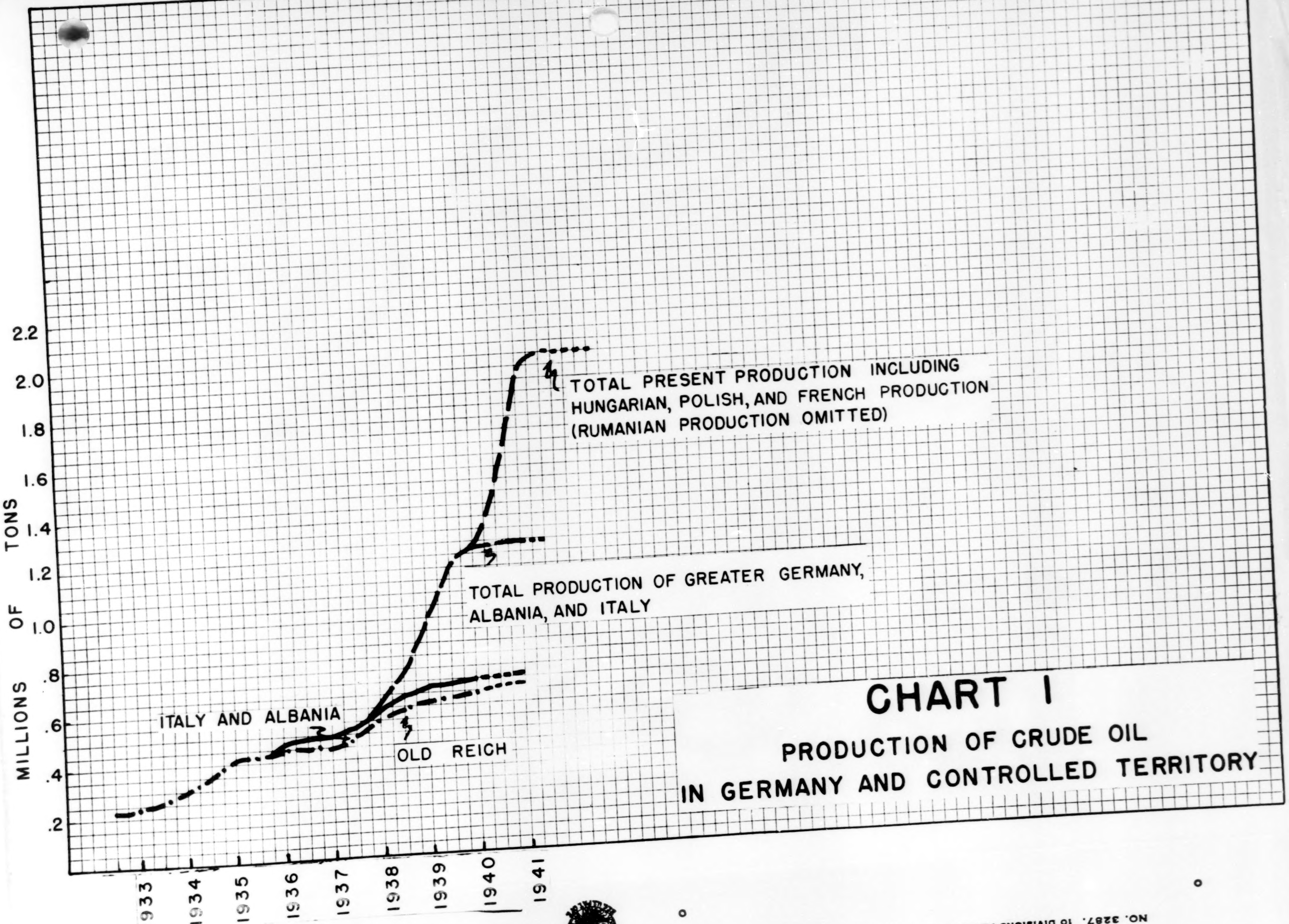

CHART I

PRODUCTION OF CRUDE OIL
IN GERMANY AND CONTROLLED TERRITORY

NO. 3287. 10 DIVISIONS PER INCH BOTH WAYS. 70 BY 100 DIVISIONS.
CODEX BOOK COMPANY, INC. NORWOOD, MASSACHUSETTS

the synthetic coal-oil plants, (3) by instituting elaborate controls on the less essential uses of petroleum.

With increased exploration and drilling, the production of crude oil more than tripled between 1934 and 1940. Production of crude for 1941 is calculated at 1 million tons a year in Greater Germany.1/ Present estimates indicate that current yearly production under the control of Greater Germany (including Hungarian, Galician, and Albanian production) is some 2 million tons.2/ (Chart 1, Table I).

To this total must also be added Rumanian oil. This country's production, the only important European source of supply, had steadily declined since the middle thirties (Chart 2); and recent German efforts to reverse this trend have been only partially successful. Present

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1/ C. S. Snodgrass (Office of Petroleum Coordinator) "Estimate of the Axis Oil Situation", October 1941, p. 2.

2/a.O.N.I. (Op-16-F-4/eod) "Summary of Estimate of Germany's Oil Position Through July 1, 1941", October 1941, estimates production for first half of 1941 at a yearly rate of 1.9 million tons, an estimate which excludes Galician production.

b.Possibly some 290,000 tons are produced in Albania, and Hungarian production is somewhat less, being some 250,000 tons per year. Galician production is some 400,000 tons. French and Italian production are estimated at 70,000 and 9,000 tons, respectively.

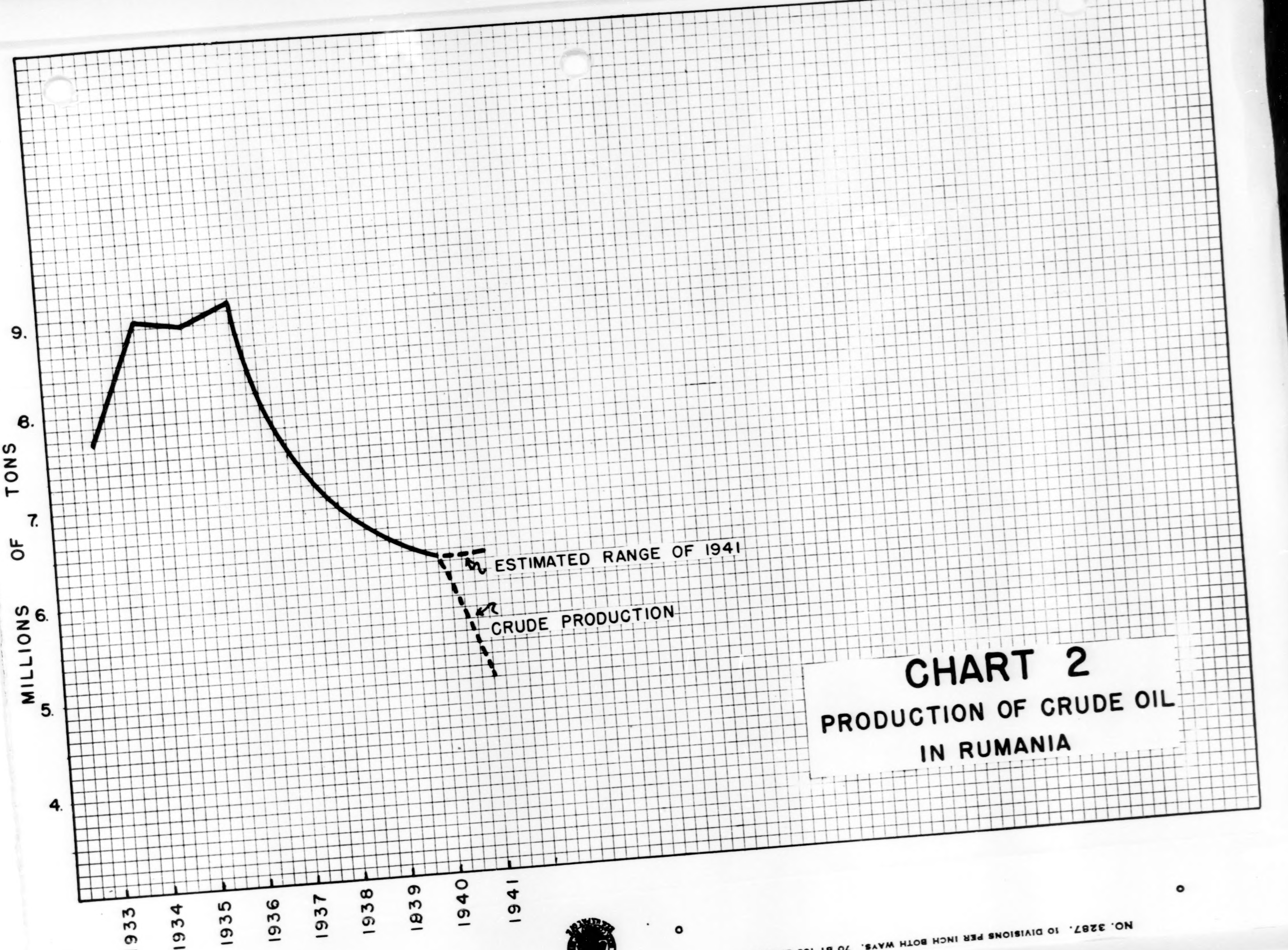

CHART 2

PRODUCTION OF CRUDE OIL IN RUMANIA

NO. 3287. 10 DIVISIONS PER INCH BOTH WAYS. 70 BY 100 DIVISIONS.
CODEX BOOK COMPANY, INC. NORWOOD, MASSACHUSETTS

production from Rumania is believed to range between 5 and 6.1 million tons.1/ Of this, some 3-400,000 tons per month are exported throughout the year.2/ These are transported principally by boat on the Danube, since the usual Black Sea-Mediterranean route has been rendered unsafe by the British blockade. An additional 50,000 tons a month are reported being shipped to Italy, France and to other Danubian countries.

Prior to June 22, 1941, German imports from Russia were believed to be proceeding at an approximate rate of 1,000,000 tons per annum. These importations, of course, ceased with the outbreak of hostilities, and the captured Galician production is estimated at a maximum of 40% of these importations--400,000 tons a year.

As shown in Table I, the crude oil production of Axis Europe as a whole comes to about 7,500,000 tons per annum.

1/ a. C. S. Snodgrass, op. cit., estimates the 1941 Rumanian production at 5 million tons.

b. Minerals Yearbook, 1940, p. 1017, gives a 1940 production estimate at 5.2 million tons.

c. Reports from the "Frankfurter Zeitung", October 7, 1941 report a production of 2,603,000 (metric) tons, (2,860,000 short tons) for the first half of the year--a yearly rate of some 5,720,000 short tons.

2/ According to our Berlin Embassy (Sam Woods report of June 10, 1941), Germany imported some 347,000 metric tons from Rumania during the first 3 months of the year. This figure represents 56 percent of total Rumanian exports which, when converted to short tons, gives the monthly export figure of some 225,000 tons. M.E.W.: "Summary of Enemy Economic Demands" #106, September 25, 1941, estimates Rumanian exports for July and August at some 560,000 tons a month, a figure which, being higher than the total production figure, suggests that stocks are being drained.

Axis Refineries

German refining capacity is estimated at some 3,500,000 tons per annum.1/ Since a relatively adequate gasoline supply is obtained from synthetic plants, the refining facilities are used to produce the maximum possible proportion of finished lubricants.2/ Rumanian refining capacity is some 9 million tons a year, but, because of outmoded equipment, relatively small amounts of lube and Diesel oils are refined,3/ and this is a serious weakness in the German petroleum situation.

Italian refining capacity is estimated at 3,000,000 at a maximum. Of this, the plants at Bari and Leghorn produce approximately 300,000 tons of gasoline a year.4/ Refineries in Western Europe, now under German control, in normal times, had capacities of some 10 million tons and it is not known to what extent these and the other Axis controlled plants are at present in use or what damage has been done to them by war, air raids, and sabotage.

A large percentage of the refineries of Axis

1/ Oil and Gas Journal, Dec. 26, 1940, pp. 94,97.

2/ a. C. S. Snodgrass, op. cit., states German capacity of finished lubes is approximately 430,000 tons per annum.
b. Walter Levy, "Oil and War", (an unpublished study), p. 18, states that most of the (German) crude ... would be used in making lubricants.

3/ Walter Levy, op. cit., pp. 228-9.

4/ Ibid., p. 37-38.

Europe have been forced to close because of lack of crude oil. The refineries of Hamburg, Bremen, Antwerp, Rotterdam 1/, and most of the Italian refineries (with the exception of Bari) are reported closed at present. It is believed that, due to the transportation problems involved and the necessity of making rapid shipments to the Eastern Front, Germany has made no attempt to run Rumanian crude through these plants and thereby compensate for the antiquated Rumanian refining equipment.

B. Synthetic Petroleum Production

The greatest part of the burden of petroleum supply in Greater Germany itself is borne by the synthetic coal-oil industry.2/ Coke, coal, lignite and the derived tars are used as source material; finished products are refined in two types of plant--the larger Bergius hydrogenation plants which specialize in the production of gasoline, and the smaller Fischer-Tropsch units which, producing under lower pressures, emphasize the production of Diesel oil, etc. Production estimates of these plants vary considerably and of course are subject to such factors as the present construction of new plants, effect of R.A.F. raids, etc. Output of gasoline (and gasoline substitutes)

1/ Army Air Corps, "Data on the Oil Supply of Axis Europe". May, 1941.

2/ Army Air Corps, *op. cit.* lists the following sources:

1.	Synthetic and substitutes	62.2%
2.	Rumanian Imports	25.0%
3.	Wells within Axis-controlled industry	10.8%
4.	Miscellaneous	2.0%
		100.0%

is estimated between 4 and 6 million tons; other petroleum products (lubes and fuel oils, etc.) are estimated at some 1 to 2 million tons per year.[1]

Total petroleum products at present available to Axis Europe may be summarized in round numbers as follows:

Total crude production:	7-8,000,000 tons
Total synthetic output:	5-8,500,000 tons
Total petroleum products:	12-16,500,000 tons

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[1] a. Walter Levy, op. cit., p. 21, gives the following data on these plants: in 1939 there were 14 hydrogenation plants having a total capacity of some 1,800,000 tons per year (an average capacity of ±120,000 tons per plant per year), and 11 Fischer-Tropsch plants producing some 560,000 tons a year (an average individual capacity of some 51,000 tons a year).

b. Army Air Corps, op. cit., estimates maximum German synthetic production as follows:

1) Bergius & Fischer-Tropsch--
   Total capacity: 6,045,000 tons
   Total gasolene production: 4,000,000 tons
   Total capacity in other petroleum products: 2,045,000 tons

2) Miscellaneous processes--
   Crude production--2,550,000 tons
   Gasolene contents (readily available): 1,800,000 tons

3) Total output--8,595,000 tons
   Gasolene equivalent (net)--5,800,000 tons
   Other petroleum products--2,795,000 tons.

c. C. S. Snodgrass, op. cit., estimates German gasolene and substitute motor fuel production at a conservative 4,000,000 tons a year.

d. O.N.I. (Op-16-F-4/eod), op. cit., estimates total synthetic production at some 4,500,000 tons.

e. Recent British estimates (London M.A. #44995--Oct. 20, 1941) estimate amount of monthly synthetic production at 44,000 tons per month, and 5,280,000 tons a year.

f. Production estimates of other petroleum productions have not been obtained; Snodgrass estimates that some 200,000 tons per year of Diesel fuel are produced in Fischer-Tropsch plants, that the total potential capacity of Diesel Fuel in Bergius plants would be 2,000,000 tons if production of other products were neglected.

This total must be proportioned among the total military, industrial, and civilian petroleum demands of Axis Europe. Factors that might account for the discrepancy in total output are the bombing of synthetic plants by the R.A.F., and the difficulties of transport. The maximum estimate may be derived from calculations assuming uninhibited production and distribution; the lower, British estimate may make a general allowance for the consequence of damage by bombing, possible decline of Rumanian production, and other restrictions on full utilization of capacity. The British Ministry of Economic Warfare announced as early as November 1940 that 90 percent of the Reich's synthetic plants had been visited and bombed by the R.A.F. ... "targets heavily hit, although production is still continuing at reduced rates."1/ Goering, on the other hand, has claimed that no damage has been suffered by these plants, a questionable statement on the face of it. A maximum estimate might place damage by bombing at 20 percent of the synthetic petroleum output. This would bring the estimates for total output appreciably closer, although an important margin still remains between the extremes. It is the existence of this margin, more than any other gap or discrepancy in the data, which precludes useful prediction as to the rate at which stocks are being reduced by the Russian war.

1/ Walter Levy, op. cit., p.142 (3).

III

THE PETROLEUM REQUIREMENTS OF AXIS EUROPE

A. Over-all Consumption

Previous to the outbreak of the war, Continental Europe annually imported some 24,000,000 tons of petroleum products a year, and domestically produced an additional 7-8,000,000 tons. Pre-war "normal" consumption was approximately 25,000,000 tons. The remainder was exported.

It is of interest to note in passing that, excepting Germany and those few countries able to meet their domestic requirements, almost no attempt to achieve self-sufficiency by synthetic processes was made by the other European countries before the war. Italy unsuccessfully attempted a plan similar to Germany's; but France and the Low Countries remained frankly dependent on foreign sources for petroleum, counting on accumulated stocks to meet temporary crises.

The war and the ensuing blockade brought about severe restrictions on civilian consumption, which, in the past two years, have been extended throughout almost the whole of the Continent. Estimates of pre-war and present consumption are given in Table II; the present estimates of 1941 civilian consumption are believed to be even lower than those shown in the table, ranging between 6 and 7 million tons. Prior to the Russian war, a summary of petroleum supplies and demands in Axis Europe would indicate that approximate stability was achieved at some 14-15,000,000 tons per annum.[1] This assumes, however, that some 4,000,000 tons were available to the military, and it is unlikely that the restricted military activities of Germany in roughly the year preceding June 1941 called for supplies on this scale. Some accretion to stocks was, therefore, likely.[2] On the other hand, there are indications that the apparent slight surplus concealed a continuing shortage in certain petroleum products, notably Diesel oil and lubricants.

It must be emphasized, in general, that the balance can be only roughly struck from available statistical evidence. The figures might be combined so as to indicate either a considerable increase in reserves in the 1940-41 interval or a substantial drain upon them. The net conclusion of a mild surplus to military stocks must be regarded as highly tentative.

B. Evidence of Shortages

There is accumulated evidence that the Continent is experiencing a shortage of Diesel and lubricating oils, amounting to possibly 1,000,000 tons a year.1/ There may exist, as well, a shortage of the higher grades of aviation fuel. Aviation fuel from synthetic plants cannot be refined to more than an 87 octane rating; although they can be stepped up to 90-94 octane rating by the addition of 5 c.c. tetra-ethyl lead per gallon. No 100 octane fuel was made before the war, nor is there any indication that this situation has been changed up to November 1940; and, due to the lack of modern refining equipment, little hope of improving the situation can come from Rumania, source of 57 percent of Axis aviation fuel. 2/

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[1] a. Walter Levy, op. cit., p. 142 (4), estimates Axis Europe's needs at some 16,000,000 tons against a supply of possibly 13,500,000 tons.

b. The British Air Ministry (as quoted in excerpts from the Army Air Corps survey) estimates a demand of 14,700,000 and a supply of 15,500,000 tons.

c. C. S. Snodgrass, op. cit., estimates petroleum consumption in Axis Europe at some 15,000,000 tons and a possible supply of some 15,500,000 tons.

[2] C. S. Snodgrass, op. cit., estimates a possible excess of gasoline of approximately 1,300,000 tons a year.

This picture of growing shortages in specific materials is reflected in reports that Diesel engines are being replaced by water turbines in parts of Switzerland, and that Belgium marine Diesels were recently ordered converted.3/

1/ a. C. S. Snodgrass, op. cit., ... "There appears to be a deficit of gas/Diesel oil estimated at 1,000,000 tons."

b. O.N.I., (Op-16-F-4/cc) Nov. 4, 1941, states that reports from widely different sources indicate a shortage, not only of high grade aviation lubricating oils, but even of heavier lubes and greases.

c. Walter Levy, op. cit., p. 268, states that "no large relief could be expected from Rumanian crude oil, for modern refining installations would be required to raise the output of high grade gasoline and lubricants."

2/ According to Snodgrass, op. cit., Axis aviation fuel comes from the following sources:

(1) Rumanian refineries	370,000 tons
(2) Bergius plants	180,000 "
(3) Fischer-Tropsch plants	38,500 "
(4) Albanian and Italian crude	81,500 "
	670,000 tons per year

3/ M.E.W. "Summary of Enemy Economic Developments," #100 Aug. 13, 1941.

German river barges and boats are also being converted from Diesel oil to producer gas.1/ It is further reported that the German law requiring the collection and reprocessing of old oil has been expanded to permit no exceptions.2/ Information furnished by Sir Andrew Agnew concludes: "There is a shortage of supply over industrial demand of 275,000 tons of lube oil per annum before allowing anything for service consumption of Italy and Germany.3/ This statement should be accepted with reserve; as it is over a year old (Sept. 26, 1940) and may, as well, reflect an unwarranted British optimism.

C. The Role of Stocks

As noted above, most of the countries of Western Europe counted on imports normally, and aimed to meet any short-time supply deficiencies by withdrawals from accumulated stocks. The accumulation of reserve stocks was, of course, a major part of the military preparations of Germany and Italy. Their joint petroleum reserves at the beginning of the war are estimated at approximately 7,500,000 tons; and, according to German sources, they

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1/ Report from the U. S. Embassy, Berlin, July 25, 1941. (State Dept. 19266).

2/ "Deutsche Volkswirt", July 18, 1941.

3/ Data on file at the Treasury Dept. (Bureau of Monetary Research).

were possibly as high as 9,500,000 tons.1/

The 18-day war with Poland involved no serious drain on German stocks; indeed, the 280,000 tons (see below, p.20) that were possibly consumed during the campaign were considerably less than one month's output of the German oil industry, according to the official report of the German General Staff. No data are available with respect to the stocks obtained in Poland; they are not, however, believed to have been great.

German petroleum acquisitions resulting from the Spring offensive of 1940 were considerable, and in fact, they are believed to have been greater than the military consumption during the campaign.2/ Estimates of these captured stocks range between 1,000,000 and 4,350,000 tons and are probably close to 2,000,000 tons. There is, however, some reason to doubt whether Germany proper directly profited from these new accumulations to any great extent.

1/ a. O.N.I., op. cit., (Op-16-F-4/eod) estimates German stocks at 5½ million tons between September 1 and December 31, 1939. This figure is substantiated by Dr. H. G. Carlson of the War Department.

b. Walter Levy, op. cit., p. 43, states that Italy "probably had as much as 15 million barrels (2 million tons) before declaring war", and that German reports suggest that this figure was between 3 and 4 million tons.

2/ Major General Van Schell (as quoted by Dr. Hoeffding, of the Economics Section of the Bureau of Mines) stated that in October 1940, Germany had larger stocks than she did in September 1939, "when the Reich already had very large stocks." It must be noted, however, that the above estimates of German oil consumption during the campaign have been colored for propaganda purposes.

It is possible that the greater proportion of these stocks remained in the occupied countries to supply the minimum civilian and industrial needs, and to help supply the armies of occupation. In fact, preparations for an invasion of England might have necessitated some transfer of German crude oil to the occupied territories.

Summary estimates of the total stocks available to the Axis prior to the Russian war range between 4 and 8 million tons. British and O.N.I. estimates 1/ place stocks in June 1941 between 4 and 5 million tons, a figure considerably lower than the amount previously estimated in the possession of Germany and Italy at the outbreak of the war. This would imply that the rate of consumption between June 1940 and June 1941 was greater than total output from all sources--a somewhat optimistic view; or that R.A.F. bombing had destroyed stocks and plant facilities on a considerable scale. A report from the officials of the Texas Oil Company to the Treasury Department indicates this as a possibility.

1/a. M.E.W., "Summary of Enemy Economic Developments", #95, July 14, 1941, estimates total stock available to the Axis as 4,850,000 tons, of which 2,850,000 tons are immobilized in transit.

b. Ibid., #99, Aug. 6, 1941, estimates total Axis stocks as 5 million tons at the outset of the Russian war.

c. O.N.I., op. cit., (Op-16-F-4/eod) estimates that Germany (and the occupied territories) had 4,000,000 tons of stocks between January 1 and June 30, 1941.

Another calculation, published in "Dagens Nyheter" (Stockholm) 1/, places Axis stocks at "a minimum of six, and possibly eight million tons," implying no great change in the stocks between the summer of 1940 and the opening of the Russian campaign. It would be of interest to see the data from which this estimate was derived, and it is urged that they be secured, if possible, via the Stockholm legation.

Other estimates, or combinations of them, even suggest the possibility that German stocks were mildly increased in this interval (see 33, Table IV). On the whole, it appears reasonable to assume that, under existing supply and consumption conditions, the German position was relatively secure at the outbreak of the Russian War; and that military stocks were somewhat enlarged in the previous year. Tables III and IV summarize the military and general petroleum consumption of Axis Europe from the outbreak of the war to date.

D. The Effect of the Russian War

Data on the military consumption of petroleum during the Russian war vary considerably, but many of the estimates suggest that the current campaign is creating

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1/ Reprinted in the New York Times, October 30, 1941.

a serious drain on Axis oil reserves. London reports 1/ estimate Axis military consumption at 440,000 tons per month, civilian consumption at 935,000 tons per month. As monthly production from all sources is estimated at 1,015,000 tons, an oil deficit of some 360,000 tons a month is suggested. These figures, however, must be used cautiously, pending further analysis, as they apparently rely heavily on a low production estimate and a rather high rate of civilian consumption.2/ This rate of stock withdrawals would, assuming other conditions unchanged, exhaust German oil resources in from six to eight months, according to the British estimates of stocks; but it is not assumed in the British analysis that the German war effort on its present scale is limited merely by the size of the total reserve: "these estimates are subject to a wide margin of error, and total consumption is on an order so much larger, that any deficiency could be transferred from the armed forces to some demand which would react less quickly to a further cut."

1/ a. M.I.D. daily summary #249, Nov. 11, 1941.

b. M.E.W. "Summary of Enemy Economic Developments", #99 Aug. 6, 1941.

2/ The British estimate of civilian consumption, 935,000 tons per month, is higher than our maximum estimate of 833,000 tons per month.

An M.I.D. table based on an assumed maximum vehicular consumption of 15 gallons per day 1/ suggests that the consumption of 179 actively engaged divisions 2/ is some 463,000 tons per month for the land forces.

An estimate of the Export Control Board 3/ states that some 9 million tons per year would be necessary for sustained operations of Army, Navy, and Air Force--some 750,000 tons per month. If one assumes civilian consumption to be held at the minimum estimate of 500,000 tons a month (6 million tons per year), it becomes apparent that the total yearly production must be some 15,000,000 tons in order to avoid any drains on stocks.

Other estimates of military consumption are even higher. The Stockholm report quoted above 4/ states that "the land war on the Eastern front is costing the Axis a

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1/ This figure is the maximum rate of consumption for the average of all American military vehicles, a consumption rate believed by M.I.D. to be greater than the German rate, applied to what M.I.D. believes to be the vehicular composition of German infantry, panzer, and motorized conditions. In figuring the consumption of any campaign, an additional 50 percent is added to the figures derived to account for G.H.Q., etc., and as both this estimate and the 15 gallons per day estimate are believed to be high, the derived total is considered as a maximum consumption estimate.

2/ M.I.D. estimate of the number of divisions on the Eastern front in December 1941. This is composed of 139 Infantry, 18 panzer, and 22 motorized divisions.

3/ "Review of Germany's Oil Situation with an Estimate for 1940", prepared by Bergen Herod (Export Control Board), January 1941, pp. 11, 12.

4/ As reprinted in the New York Times, Oct. 30, 1941.

minimum of almost 45,000 tons a day and that Axis aircraft are using 3,500 tons a day". This would yield the high consumption rate of 1,450,000 tons per month, and if the above mentioned minimum civilian consumption be added to this figure, total consumption, amounting to some 1,950,000 tons a month would create a monthly deficit of some 575,000 tons even if our maximum production estimate of 1,375,000 tons were used. An even higher consumption estimate has recently come from Russia 1/, which predicts that the Axis faces an oil deficit of some 18,000,000 tons for the first

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1/ Printed in the Dec. 5, 1941 issue of the Washington Post, this article is a report by C. L. Sulzberger on the Axis petroleum estimates made by Maj. Gen. Pitor Kotoff of the Soviet Tank Army. His estimates of yearly consumption are summarized as follows:

(In tons)

Estimated stocks, June 1941	+7,000,000	
Crude production	+7,000,000	
Synthetic production	+5,100,000	
Total Production		+12,100,000
Civilian consumption	- 6,000,000	
Military consumption	-24,000,000	
Total consumption	-30,000,000	
Production-consumption balance		-17,900,000
Yearly Drain on Stocks		+ 7,000,000
Total yearly deficit		-10,900,000

It should be noted that these production estimates are some 2,000,000 tons a year less than ours (which neglect damage by R.A.F.) and that the estimate for military consumption is far in excess of any estimates previously given. The civilian consumption estimate is low, but possibly correct in the light of recent restrictions.

year of the war and that there are on hand only some 7,000,000 tons of stocks to draw upon.

Any attempted check on the validity of these extremely discrepant figures must consider the consumption estimates of the previous campaigns in Poland and the West. The nineteen day Polish campaign is believed to have consumed approximately 280,000 tons 1/, an equivalent monthly consumption rate of some 468,000 tons. Estimates of the spring offensive of 1940 are considerably higher than those of the Polish Campaign and range between 982,000 and 1,500,000 tons--monthly consumption estimates of 640,000 to 980,000 tons.2/ M.I.D. believes that out of a total

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1/ a. M.I.D. estimates (as quoted in O.N.I., Op-16-F-4/eod) a total consumption of some 280,000 tons of gasolene (2,400,000 mill. bbls.) "and considerable quantities of lubricants".

b. Walter Levy, op. cit., p. 113, estimates that less than 300,000 tons of petroleum products were consumed during this campaign.

c. The Export Control Board, op. cit., estimates the consumption in this campaign at a rate of 5.68 million tons a year--some 280,000 tons for the campaign.

2/ a. Dagens Nyheter (Stockholm), op. cit., estimates a consumption of 1,500,000 tons for the campaign as does Maj. Gen. Pitor Kotoff in the Washington Post article, op.cit.

b. Walter Levy, op. cit., p. 117, estimates a consumption of 9 to 10 million bbls.--some 1.2 to 1.3 million tons.

c. Export Control Board, op. cit., estimates the consumption of this campaign at a yearly rate of 7.8 million tons--a consumption for the 46 day campaign of some 982,000 tons.

of 150 divisions, only 52 were actively engaged, and that possibly some 120 to 140 saw action in the West. It is therefore not surprising that the estimates of monthly consumption in the latter campaign are larger than those of the Polish War.

If one uses the M.I.D. vehicular consumption tables mentioned above to approximate consumption in the Polish Campaign, an estimate of some 277,000 tons is obtained if one allows some 70,000 tons for possible air consumption. Again, using these tables and assuming that some 150 divisions were active on the Western Front and that an additional 50 were held as reserves, one obtains a consumption estimate of some 676,000 tons, a total consumption of some 866,000 tons if one allows 190,000 tons for possible aviation consumption.

Thus, it will be noted that our estimates of the Polish campaign closely check the other estimates given above, but that our estimates for the Spring campaign are decidedly lower than the others at present available. Our estimations of consumption of the Eastern front are also derived from the M.I.D. tables and therefore check their estimate of some 463,000 tons per month given above. To this we have added some 65,000 tons for possible consumption by the Air Forces [1]--a figure believed high by M.I.D. Thus consumption on the Eastern front may be estimated at a maximum of 528,000 tons a month. Total military consumption, however, is in excess of this, as an additional 79,000 tons per month for the estimated reserve divisions must be added 1/, plus an additional 63,000 for naval and air consumption in the West.2/ Thus, present total Axis military consumption may be roughly estimated as follows:

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[1] London M.A. (#44995) on file at M.I.D.--Central European Division.

Eastern Front	=	528,000
Reserves	=	79,000
Air and Navy	=	63,000
Total	=	670,000

This total figure of 670,000 tons per month is, as has been previously mentioned, a maximum estimate. However, the consumption in Africa, believed to be slight, and the amount of lubricants required (possibly 3 percent of the total fuel consumption) would raise the actual figures, and it is therefore believed that the above figure for total consumption may not be excessively in error. Total consumption for 6 months is some 4,020,000 tons, a figure that roughly checks the Estimate of the Export Control Board 3/ of some 4.5 million tons for sustained operations for a half year. Our estimates of German military consumption since September 1939 are summarized in Table III.

1/ These divisions are not considered to be following the battle as they were in the Western Campaign, but are considered to be stationed in Germany and the Occupied territory. A consumption rate of half that assumed in the tables for reserves has been used in obtaining the above estimate.

2/ Derivation of these estimates given in explanatory notes attached to Table III.

3/ Export Control Board, *op. cit.*

Accepting the above military consumption estimate as being approximately correct, the possible strain on Axis economy then becomes a function of production and civilian consumption. In Table V we have shown possible estimates on a yearly basis assuming civilian consumption to range between 6,000,000 and 10,000,000 tons and production to range between 12,180,000 and 16,500,000.1/

It will be noted that the estimates derived range from a yearly deficit of 5,860,000 tons to possible stock accretions of 2,460,000 tons. In all probability civilian consumption has been so restricted that the lower figure more closely approximates actual conditions. Possibly some 7 million tons a year are being so consumed and total production is believed at present to be closer to 14.5 tons.2/

These figures, as is shown on Table V, give an annual drain of some 540,000 tons--a rate of 45,000 tons per month.

A reasonable, but at the moment not verifiable net conclusion appears to be that the Russian war involves some depletion of German petroleum stocks. The moment of crisis can not, however, be predicted.

1/ Lower civilian estimate comes from the above mentioned Washington Post article and is believed substantially correct by Dr. H. G. Carlson of M.I.D. Higher figure is obtained from the Export Control Board, *op. cit.*, data given in Table IV. Production estimates are derived from (1) the British M.A. (#44993) estimate of 1,015,000 tons per month, and (2) our maximum consumption estimate.

2/ Mr. Herod of the Export Control Board and Dr. Carlson of M.I.D. estimate total production at 15 million tons.

E. Factors Mitigating the Shortage

The fact that stocks are now being depleted does not lead unequivocally to the conclusion that the drain must be continuous. It is, in the first place, likely that the Russian war has at present become relatively static for the duration of the Winter. Manpower, war materiel, and transport may prove more serious bottlenecks, in fact, than the petroleum supply. It is, further, possible that the fairly accessible oil fields of the Northern Caucasus will eventually fall into German hands. It is unlikely that even vigorous Russian sabotage is capable of preventing a considerable petroleum supply from accruing to the Germans, within a fairly short period of time.

Two other factors may relieve the German position. The Rumanian oil fields and refineries might increase their output under the guidance of German technicians; and the supply routes to Germany and the Eastern Front, from Rumania, may be improved. The line from Cernauti to Lemberg is already reported to have been re-converted to standard gauge. In addition, it is known that most of the new synthetic plants are under construction in regions secure from aerial attack: in Eastern Germany and Silesia.1/

Finally, the possibilities of further civilian economy, through lower rations and further transfers to producer gas, have not been fully exploited. The extended

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1/ Army Air Corps report, op. cit.

use of producer gas was estimated to have saved 645,000 tons of petroleum in 1941; 1/ and the wide margin in per capita civilian consumption between Germany and occupied Europe suggests that an absolute minimum has not yet been reached in that direction.

IV

CONCLUSION

Thus, as in the case of other minerals examined, present evidence on the general German petroleum position does not appear to justify a prediction of immediate crisis, or crisis within the next calendar year. Almost unquestionably the large stocks held before June 1941 are being somewhat depleted; but their size, and the estimated rate of their depletion is such as to cause no immediate strain on the German economy. Shortages of specific materials, principally lubricants, may become critical, but there is no direct evidence that this condition will be reached during the coming year.

1/ O.N.I. report of statement by Major General Van Schell, Director of German Motor Fuel Corp.

TABLE I - AXIS-EUROPE CRUDE PRODUCTION
(in tons)

COUNTRY	1939 1)	1940 2)	1941
Rumania	6,570,000	6,170,000	(5,000,000[3] (6,125,000[4]
Germany	642,000	650,000	1,000,000[5]
Poland	557,000	556,000	400,000[6]
Hungary	150,600	250,300	250,000[7]
Albania	133,300	237,000	290,000[8]
Austria	99,200	103,000	[9]
France	71,500	71,000	45,000[10]
Czechoslovakia	17,200	17,100	[11]
Italy	13,000	8,100	7,000[12]
Total	8,253,800	8,058,500	7,000,000 - 8,000,000[13]

1. Minerals Year Book, Review of 1940 (Bureau of Mines) - p. 1017.

2. Op. cit.- approximate production - derevied in part from World Petroleum, vol. 12 #2, Feb. '41, pp. 20-21.

3. C. S. Snodgrass (Off. Pet. Coordinator) "Estimate of Axis Oil Situation" - p. 1.

4. Walter Levy "Oil and War" - p.228 - estimate of poss. maximum production.

5. C. S. Snodgrass - op. cit. Figure is believed to represent Greater Germany.

6. Total Polish production assumed to remain unchanged between 1940-'41. Some 150,000 T. of "German" Polish production believed to be incorporated in.5/

7. Est. From Walter Levy, op. cit., pp. 84-5. (Includes ceded parts of Czechoslovakia and Rumania.

8. Figure derived by assuming an extrapolation of production figures from previous production figures.

9. See 5.

10. French production estimate by O.N.I.

11. See 5.

12. Extrapolation of production curve; data obtained from previous production figures.

13. Total in round numbers.

SECRET

TABLE II. Comparison of "Normal" and Present Petroleum Consumption in Axis Europe

(thousands of tons)

Country	"Normal" - 1938 - Consumption	Estimated 1941 Consumption		
		Civilian	Available for Military	Total
	(1) (3)	(5)	(13) (15)	(17) [19]
1. Germany.........	6,895 - 7,000	3,900 - 3,500 [7]	3,600 - 5,000	7,500 - 8,500
2. Italy-Albania...	3,255 - 3,535	1,300 - 1,500 +[7]	1,200 - 1,000	2,500 - 2,500
3. France..........	6,005 - 6,500	1,620 - 924 [8] (514-free) (410-occ.)		1,620 - 924
4. Denmark.........	784 - 872	135 - 175 [9]		135 - 175
5. Holland.........	1,558 - 1,250	290 - 150 [9]		290 - 150
6. Belgium.........	784 - 693	190 - 83 [9]		190 - 83
7. Norway..........	553 - 574	150 - 144 [9]		150 - 144
8. Hungary.........	232 - 380	135 - 95 [9]		135 - 95
9. Rumania.........	1,695 - 1,562	1,751 - 1,000 +[10]		1,751 - 1,000
10. Yugoslavia......	146 - 150	86 - 30 [11]		86 - 30
11. Bulgaria........	103 - 380	65 - 76 [11]		65 - 76
12. Switzerland.....	445 - 435	240 - 165 [10]		240 - 165
Total.........	22,455[2]-23,331[4]	9,860[6]-7,850 [12]	4,800[14]-6,000 [16]	14,660[18]-13,850 [20]

[1.-2.] Data derived from "Estimate of Supply and Consumption of Liquid Fuels in Axis Europe - 1941" (Office of Administration of Export Control - 5/2/41). It will be noted that Greece, Sweden, and Finland are omitted from these tables. Their "normal" consumption amounted to some 1,800,000 tons per annum, bringing the total Axis Europe "normal" estimates to some 24,000,000 tons.

3.-4. Data derived from table given in Walter Levy's "Oil and War". Yugoslavia's estimate is derived from data on imports to that country. See 1. for Greece, Sweden, and Finland.

5.-6. Derived from 1. No estimates given for Greece, Sweden, and Finland - estimated at possibly ½ million tons.

7. Derived from Walter Levy, "Oil and War" - p. 105 et seq.; and pp. 145, 146.

8. Estimate of M.E.W.: S.E.E.D. (5/21/41) #88.

9. Data derived by applying Army Air Corps ("Study of Axis Oil Situation" - material submitted by Major Olive 10/30/41) estimates of present to pre-war consumption estimates of 3. These present estimates are as follows: Denmark, 12%; Netherlands, 12%; Norway, 25%; Hungary, 25%.

10. Estimate by M.E.W.: S.E.E.D. #95 (7/14/41).

11. Estimated at 20% - no data available other than Army Air Corps estimate (see 6.) of 15% for the Balkans in general.

12. Civilian consumption is at present believed to be even less than the figure given here. As shown in Table IV, total yearly consumption falls within the range given in 6. and 12. but is at present estimated at some 7 million tons per year.

13. See 1.

14. Self-explanatory.

15. Derived by subtracting an approximate 8,500,000 tons (7,850,000 plus 500,000 tons for other "neutrals") from estimated total production of 14,500,000 tons. Of this remainder of 6,000,000 tons, 1,000,000 are allocated to Italy. (Levy's estimate). Total Italian demands are approximately 2,500,000 tons, and of that, civilian demands are estimated at 1,500,000 tons.

16. Self-explanatory.

17. Totals of 13. and 5.

18. Self-explanatory. As shown in Table IV, present total consumption for the year approximates this sum, but is derived from slightly different sources.

19. Sum of 3. and 7.

20. Self-explanatory.

SECRET

TABLE III

Estimate of German Military Consumption of Petroleum

(In thousands of tons)

Period		Campaign	Total Consumption	Army (GHQ, etc.)	Air	Navy
Sept. 1939 to June 1940	1)	Polish (19 days: 150 divisions, plus Air force 1/)*	277 2/	207.5 3/	70 4/	5/
	2)	Western (46 days: 200 divisions, plus Air Force 6/)**	860 7/	670 8/	190 9/	10/
	3)	Estimated consumption between campaigns (8 months: 200 reserve divisions, plus Air Force and Navy (10 months)11/	2,042 12/	1,040 13/	472 14/	530 15/
			3,179 16/			
July 1940 to Dec. 1940	1)	Estimated consumption between campaigns (6 months: 200 reserve divisions, Air Force, and Navy) 17/	1,394 18/	720 19/	354 20/	320 21/
			1,394 22/			
Jan. 1941 to June 1941	1)	**Balkan Campaign** (21 days (est) 28 divisions; plus Air Force) 23/	81 24/	57 25/	24 26/	27/
	2)	Estimated consumption between campaigns (6 months: 250 Reserve Divisions, plus Air Force and Navy) 28/	1,649 29/	975 30/	354 31/	320 32/
			1,730 33/			
July 1941 to Dec. 1941	1)	Russian Campaign (6 months: 179 divisions - active)34/***	3,490 35/	2,780 36/	390 37/	320 38/
		(6 months: 121 divisions - reserve) 39/	530 40/	470 41/	60 42/	
			4,020 43/			

* 130 Infantry, 14 Panzer, 6 motorized = 150 divisions.

** 130 Infantry, 14 Panzer, 6 motorized, 50 reserve = 200 divisions.

*** 139 Infantry, 18 Panzer, 22 motorized = 179 divisions

Notes on Table III

1/ M.I.D. estimates that there were 52 active, 73 reserve, and 25 reserve divisions being formed at the time of the Polish Campaign - a total of 150 divisions.

2/ Sum of 3/ and 4/. Export Control Board ("Review of Germany's Oil Situation with an Estimate for 1941" - Jan. 1941) estimates the consumption for this campaign at a yearly rate of 5.68 million tons or 280,000 tons for the campaign.

3/ Estimate derived from M.I.D. table (assuming an overall vehicular consumption of 15 gallons per day) for 150 divisions - 130 Infantry, 14 panzer, 6 motorized, plus an added 50% for GHQ, etc. - for a 19 day campaign.

4/ This estimate of aviation consumption is subject to a wide margin of error; it was estimated by assuming Germany used 7,000 planes (i.e., engines) 4 hours per day with a daily consumption rate of 50 gallons per hour.

5/ See 15/

6/ M.I.D. estimates a maximum of 150 divisions in use in the Western Campaigns. To this we have added 50 reserve divisions and approximated the consumption of these 200 divisions by using the M.I.D. tables.

7/ Sum of 8/ and 9/. Export Control Board, op.cit., estimated a petroleum consumption during these campaigns at a yearly rate of 7.8 million tons - a total for the 46 day campaign of 980,000 tons.

8/ Derived from M.I.D. tables by assuming that the above mentioned 200 divisions were composed of 130 infantry, 14 panzer, 6 motorized and 50 reserve divisions.

9/ This aviation consumption estimate is also highly questionable, and it is a possibly high figure. It is derived by assuming that Germany had 9,000 planes (i.e., motors) in operation, each flying 4 hours a day and burning 50 gallons per hour.

10/ See 15/

11/ No demobilization has been assumed for the 8 months during which there was no active fighting.

12/ Sum of 13/ and 14/

13/ We have obtained this figure by using half the reserve division estimate given in the M.I.D. tables; as these figures - 43.5 tons per day per division - assume a consumption equal to that of an active infantry division

14/ M.I.D. (given in O.N.I. "Summary of Estimate of Germany's Oil Position Through July 1941" - Op-16-F-4/eod) estimate of air and naval consumption for the first four months of this period at some 110,000 tons per month. We have arbitrarily assumed that the airforce consumes some 59,000 tons per month and that the navy consumes the remainder - some 53,000 tons per month. Lacking more precise data we have used these figures for estimating the "normal" consumption of these armed forces throughout this table.

15/ Naval estimates are based on the entire 10 months period. The two campaigns of this period are not believed to have caused any great naval consumption. See 14/.

16/ Sum of 2/, 7/, and 12/.

17/ The same number of divisions are assumed to be kept in reserve during this period as was given in 11/.

18/ Sum of 19/, 20/, and 21/.

19/ Six months estimate as explained in 13/.

20/ See 14/.

21/ See 14/.

22/ See 18/.

23/ A maximum of 28 divisions are believed to have been used in the Balkan campaign, and it is believed by M.I.D. that probably only 5 of these saw continuously active combat. Time estimates for this campaign are difficult to make (as indeed, the fighting still continues) and it is hoped that our possible under-estimation of the number of days fighting is balanced by a probably maximum estimate of fuel consumption. In all events, the total consumption is not a very large amount.

24/ Sum of 25/ and 26/.

25/ Estimate derived from M.I.D. table by assuming that of the 28 divisions engaged, there were 18 infantry, 6 panzer, and 4 motorized.

26/ A relatively high percentage of aviation fuel is believed consumed in this campaign, largely due to the invasion of Crete. This figure is arbitrarily chosen and is open to question.

27/ Naval consumption of petroleum is believed slight, notwithstanding the invasion of Crete. As no precise data are available, we have included the naval consumption for this campaign in 32/.

28/ Fifty more reserve divisions are assumed to have been added during this period, bringing the total to 250 divisions.

29/ Sum of 30/ and 31/.

30/ See 13/ for the derivation of this consumption.

31/ See 14/ and 20/.

32/ See 27/, 21/, and 15/ and 14/.

33/ Sum of 24/ and 29/.

34/ Of the 179 divisions believed to be on the Eastern Front at present, M.I.D. estimates 139 to be infantry, 18 panzer, and 22 motorized.

35/ Sum of 36/, 37/, and 38/.

36/ This figure is derived from the M.I.D. estimate of 179 actively engaged divisions (see 34/) by the use of their tables.

37/ British estimates (London M.A. #44995), 10/20/41, of present air consumption on the Eastern Front are put at 65,000 tons a month.

38/ Naval consumption assumed to remain unchanged due to lack of precise data. See 14/, 15/.

39/ The remaining 115 divisions are believed to be reserves in Germany and the occupied territory, and their petroleum consumption is estimated by the method as explained in 13/.

40/ Sum of 41/and 42/

41/ See 39/.

42/ An arbitrary figure of 10,000 tons per month has been assumed to cover flying in the West, etc.

43/ Sum of 35/ and 40/. Export Control Board, (op.cit.), estimates sustained operations of all 3 branches of service at 4.5 million tons per 6 months. As will be noted, our figure is somewhat lower, being some 4 million tons.

S E C R E T

TABLE IV

ESTIMATED PETROLEUM INVENTORY FOR AXIS EUROPE
(in thousands of tons)

Period	Country	Stocks at Beginning of Period	New Supplies			Consumption			Stocks			Stocks On Hand at End of Period
			Total	Production	Imports	Total	Civilian	Military	Indicated Change	Stocks Destroyed	Stocks Captured	
	1	2	3	4	5	6	7	8	9	10	11	12
Sept. 1939 - June 1940 (10 months)	Gr. Germany	5,500	4,950	4,000	950	6,879	3,700	3,179	-1,929	?	2,000	5,571
	13	14	15	16	17	18	19	20	21	22	23	24
July 1940 - Dec. 1940 (6 months)	Gr. Germany, Italy, and dominated countries	7,571*	4,875	3,200	1,675	5,594	4,200	1,394	- 719	-100	—	6,752
	25	26	27	28	29	30	31	32	33	34	35	36
Jan. 1941 - June 1941 (6 months)	Axis-Europe	6,752	7,550	7,050	500	6,730	5,000	1,730	+ 820	?	?	7,572
	37	38	39	40	41	42	43	44	45	46	47	48
July 1941 - Dec. 1941 (6 months)	Axis-Europe	7,572	7,250	7,250	—	7,520	3,500	4,020	- 270	?	?	7,302

* Includes Italy's estimated stocks

NOTES ON TABLE IV

1/ Data presented between August 1939 and June 1940 are for Greater Germany, and include Austria, Czechoslovakia and "German" Poland.

2/ Estimate of O.N.I. "Summary of Estimate of Germany's Oil Position Through July, 1941" (op-16-F-4/EOD). This estimate is comparable with that of Dr. H. G. Carlson of M.I.D. whose estimate ranged between 5 and 6 million tons.

3/ Sum of 4/ and 5/.

4/ Estimate of O.N.I., op.cit. Our estimate differs only slightly from this, being 4,150,000 tons (derived from 900,000 tons crude output; 3,250,000 synthetic output).

5/ O.N.I., op.cit., estimate is approximately 900,000 tons. We have attempted an independent estimate which differs from the above by assuming larger importations from Rumania. The figure given is the average of these two estimates.

6/ Sum of 7/ and 8/.

7/ O.N.I., op.cit., estimates a civilain consumption of some 3,400,000 tons for this period. Our estimate assumes a consumption of some 4 million tons -- a possibly high figure. Estimate given in table is the average of these two.

8/ Military consumption is derived from data presented in Table III (1/ 15/).

9/ Remainder derived by subtracting 3/ from 6/.

10/ At present there is no precise knowledge available as to the damage to Axis stocks during this period.

11/ Two million tons are believed to approximate the stocks captured in the Spring campaign (there being no data on those obtained in Poland). O.N.I., op.cit., estimates these as low as 1 million tons, and a State Department estimate places the captured French stocks at 3 million tons, and other stocks acquired probably bring the total to 4 million tons.

12/ Algebraic sum of 2/, 9/, and 11/.

13/ Data presented between July and December 1940 include Greater Germany, Italy, Albania, and the occupied Territories -- Denmark, Norway, the Lowlands and all of France, as Vichy is dependent on the Reich for oil.

14/ This figure is derived from 12/ plus the estimated 2 million tons believed held by Italy (Walter Levy "Oil and War", an unpublished study, p. 43) at the time of her entry into the war.

15/ Sum of 16/ and 17/.

16/ O.N.I., op.cit., estimates some 3 million tons production (to which we have added 300,000 tons for possible Italian and Albanian output); our estimate is slightly less -- being based on a half year's estimate of 2.5 million tons synthetic production and 600,000 tons crude production. Estimate given in table is average of these two.

17/ O.N.I. estimates the petroleum imports at 1,800,000 tons (to which we have added 150,000 tons for Italian importations). Our estimate is lower, based on an estimated 900,000 tons of Rumanian importations (half the yearly figure given by Walter Levy, op.cit.) plus an estimate of 500,000 tons from Russia and Estonia. Figure in table is average of these two estimates.

18/ Sum of 19/ and 20/.

19/ O.N.I., op.cit., estimates civilian consumption during this period at 3,400,000 tons, to which we have added 750,000 tons for possible Italian consumption. Our estimate is 4,250,000 tons, and the figure given is the average of these two estimates.

20/ Military consumption derived from data presented in Table III (16/-20/).

21/ Remainder derived by subtracting 15/ from 18/.

22/ Estimate of Texaco officials (to the Treasury Department) of damage done to French stocks by the R.A.F.

23/ No campaign in this period.

24/ Algebraic sum of 14/, 21/, and 22/.

25/ Data presented between January and June 1941 include the same countries as given in 13/, plus the Balkans.

26/ See 24/.

27/ Sum of 28/ and 29/.

28/ Our estimate is derived by taking half a yearly output of some 14,100,000 tons (6.5 million synthetic, 7.6 million crude).

29/ Possible maximum importations from Russia and Estonia during this period.

30/ Sum of 31/and 32/.

31/ Based on a maximum yearly civilian consumption estimate of 10 million tons (Table II).

32/ Military consumption derived from data presented in Table IV (21/ - 30/).

33/ Remainder derived by subtracting 30/ from 27/.

34/ No data available at present; we have assumed no damage to stocks by air raids.

35/ Captured stocks in Greece and Yugoslavia are believed to be slight.

36/ Algebraic sum of 26/ and 33/.

37/ Axis Europe, as here considered, includes the same countries listed in 13/ and 25/ plus "Russian" Poland.

38/ See 36/.

39/ See 40/.

40/ Estimate based on yearly production of 14,500,000 tons. (This is the same estimate as given in 28/, but allows an additional 400,000 tons for production in "Russian" Poland.)

41/ With the invasion of Russia, importations into Axis Europe are believed to have ceased.

42/ Sum of 43/ and 44/.

43/ This figure is the average of 1) an estimate of some 8 million tons (Germany 3.6, Italy 1.4 (see Table #4), Rumania 1.4, Occupied Territories 1.6 (M.E.W.:SEED #95) and the estimates of Gen. Pitor Kotoff of the Soviet Tank Corps (as published in the Washington Post 12/5/41) and Dr. H. G. Carlson of M.I.D., who estimates present civilian consumption at a yearly rate of 6,000,000 tons.

44/ Military consumption derived from Table III, (31/-38/).

45/ Remainder obtained by subtracting 39/ from 42/.

46/ No data available at present; we have assumed no damage by the R.A.F.

47/ No estimate is at present available of captured Russian stocks.

48/ Algebraic sum of 38/ and 45/.

TABLE V

Estimates of Axis Stock Positions Assuming Constant Military Consumption with Variable Civilian Consumption and Production

Yearly Military Consumption	Yearly Civilian Consumption	Total Consumption	Yearly Production	Indicated Change per Year	Indicated Change per Month
		(In thousands of tons)			
8,040	6,000	14,040	12,180	- 1,860	- 155
8,040	10,000	18,040	12,180	- 5,860	- 488
8,040	6,000	14,040	14,500	+ 460	+ 38
8,040	7,000	15,040	14,500	- 540	- 45
8,040	10,000	18,040	14,500	- 3,540	- 295
8,040	6,000	14,040	16,500	+ 2,460	+ 205
8,040	10,000	18,040	16,500	- 1,540	- 128

SECRET

GERMAN TRANSPORT SITUATION

December 11, 1941

Coordinator of Information

GERMAN TRANSPORT SITUATION

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GERMAN TRANSPORT SITUATION

Summary and Conclusions

Summary

1. The view that German railway plant and equipment had been allowed to lapse into poor physical condition prior to the outbreak of war cannot be supported. There were, however, fewer freight cars and locomotives in 1938 than in 1929. But with more intensive utilization more freight was carried. By the outbreak of war the limits to more intensive use had about been reached; the transport "reserve" consisted mainly of the opportunity to curtail civilian services. Reliance was apparently placed also on the success of Blitzkrieg tactics and acquisitions of rolling stock by conquest.

2. The German network of rail, water, and roadways was, of all those in Europe, uniquely capable of carrying the loads that might be imposed on it. The transport systems of eastern and southeastern Europe, and of Russia, were much less adequate for the tasks to which they were to be subjected. Also, the rolling stock of these areas was inferior in quality and quantity relatively to that of Germany. It may be contended that the successive acquisitions of transport responsibilities in Austria, Czechoslovakia, Poland, and the Balkans served more to attenuate than to strengthen the German transport position. France and the Low Countries, however, appear to have had a surplus of

rolling stock with respect to minimum needs.

3. After the outbreak of war the traffic burden on rail and waterways was increased owing to curtailment of coastwise and overseas shipping, and of trucking (gasoline shortage). Other factors were the relocation of industry, necessitating longer hauls for many bulky commodities, and the forced development of synthetic and ersatz products and substitutes requiring the more extensive use and transport of such commodities as coal, bauxite, potatoes, and wood pulp. Reduced output of non-essential products was probably not sufficient to offset completely the factors mentioned. The special demands of the several military campaigns were superimposed on this situation. By curbing passenger service and the transport of nonessential goods, by making still further efforts to use existing equipment more intensively, and by avoiding, perhaps intentionally, coincidence of military demands with the harvest peak in traffic movement, all foreseeable contingencies were apparently met successfully. Meanwhile, a more active building program, and a severe levy on the rolling-stock reservoir of Western Europe, especially France, served to expand the stock of mobile equipment.

4. The extraordinarily severe winter of 1939 - 40 temporarily subjected the railroads in Germany and Central Europe to enormous strain. German waterways, which ordinarily carry 25 per cent of all freight by weight and 40 per cent by ton kilometers, and the great Danube route, were

virtually useless for several weeks. The railroads, themselves blocked with snow and ice, were unable to assume the burden, and many houses and industrial establishments went without coal at frequent intervals.

5. Up to the beginning of the Russian campaign the transport facilities under German control were adequate. It was necessary to economize their use, and there was occasional congestion, but there is no evidence of any severe shortage, even during military operations. In fact, it is not improbable that the expansion in rolling stock through new construction and levies on the Western European countries had eased the German position in June 1941 as compared with August 1939. Even the bottleneck in the facilities for transporting Rumanian oil appears to have been eased by the early autumn of 1941.

6. Notwithstanding this relatively favorable situation, the invasion of Russia changed the picture rather radically. The unprecedented magnitude of military operations, the ever-increasing length of haul as troops penetrated further to the East and South, the relative scarcity of rail facilities, the need to alter the gauge of those that were available, and the Russian policy of leaving the area bare of usable equipment and trained personnel, necessitated serious extensions of the railway motive power, rolling stock, and personnel available to Germany. The effects of this situation are beginning to appear. Retail clothing stocks in Berlin became depleted; crops were not

moved to urban centers at the accustomed time; coal, which otherwise would presumably have gone to Italy or Sweden, accumulated at pit-heads in Upper Silesia; measures were taken to induce the use of waterways and to permit overloading of freight cars; hours of work for railway personnel were increased. These and other items suggest that the present pinch is greater than at any time except the Winter of 1939-40.

Although there is danger of exaggerating the seriousness of the situation, the causes of the existing strain may prove to be less transitory than those of two years ago, and their cumulative effect consequently greater. If they persist it is not unlikely that the winter, which is a difficult period for transport at best, will bring still further evidence of strain. Further investigation is required before the seriousness of either present or future difficulties can be adequately appraised, but there can be no doubt that difficulties exist and must be met. These difficulties appear to be particularly serious in the east and southeast sections of Greater Germany and Europe.

Conclusions

1. Owing mainly to the demands of the Russian campaign, a shortage of transport facilities is one of the major economic problems confronting Germany today.

2. This situation is attributable basically to a shortage of railway carrying capacity - locomotives, freight cars, and tank cars. Inadequacies of fixed plant - railway

trackage, waterways, highways, pipe lines, terminal facilities - in eastern and southeastern Europe and Russia, and lack of sufficient experienced personnel to cope with magnified transport problems, are contributing factors.

3. One result of the transport shortage is the appearance of localized shortages of goods which otherwise would be available for industrial and civilian use. Since civilian supplies are already close to the limits of sustainable tolerability, and since industrial activity is being pushed to the limit, the effects of such localized shortages are cumulative. Those that have appeared thus far are probably not serious, however. Another result is that organizational and material resources which are vitally needed in uses that contribute more directly to military success must be devoted to the alleviation of the transport problem. This, also, will have cumulative effects, but thus far they do not appear to have been serious.

4. The winter is likely to be a testing period, unless military needs decline sharply. The extent to which serious interruptions occur to the movement of basic commodities - coal, petroleum, bauxite, bulk foods, and building materials - may indicate whether or not the German transport position is basically sound.

SECRET

GERMAN TRANSPORT SITUATION

I

INTRODUCTION

Adequate study of the German transport situation today involves consideration of the transport situation of the whole continent of Europe. Germany depends in varying degree on the entire area for supplies and support and is, in turn, a major source for coal, petroleum, and other vital products. For purposes of initial analysis, however, the study can reasonably be narrowed to a consideration of the stock of mobile equipment - locomotives, freight cars, and tank cars - available for German use. Other elements in the picture are relatively less important, although they should be studied more intensively as time permits.

The great concentration of freight traffic in Europe under ordinary conditions is in Germany and the West, where rail, water, and road transport systems have been highly integrated. A glance at the railway map of Europe shows that in this area, and above all in Germany, there is a veritable Chinese checkerboard of intersecting lines. Canal, river, and highway systems are also highly developed, and are supplemented to an important degree by the opportunities for intercoastal traffic. Under these conditions route capacities are less important than where facilities are strictly limited and attention can be directed initially to the availability and capacity of mobile equipment.1/

1/ Consideration will be given later to the question of routes. A study of the strategic military and economic routes, particularly in east and southeast Europe and in Russia, is in progress.

The stock of mobile equipment includes, in addition to that of the railways, the barges used on the inland waterways, ships for intercoastal traffic, and commercial motor vehicles. Lack of time has prevented adequate consideration of all these factors. They are clearly inferior in importance to the railways, however. The use of commercial vehicles for long-haul traffic has been abandoned almost entirely in Germany and, presumably, the rest of Europe since the outbreak of war. Many of the vehicles have been requisitioned for military use, and the rest have been kept off the highways by the shortage of gasoline. Even local short-haul traffic has been inhibited by the latter factor, if this interpretation can be placed on recent orders that 25 percent of all horses unfit for military service shall be allocated to transport concerns to facilitate distribution of coal, and 75 percent shall be made available to the Reich food offices. 1/

Until the outbreak of war with Russia coastal shipping in the Baltic could proceed without hindrance, and even now, apparently, is not interfered with extensively. Similarly, Axis shipping has not been seriously interrupted in many sections of the Mediterranean region; even along the west coast, from Spain northward to Denmark, a considerable volume of Axis trade is still carried on. The coastal trade is not, therefore, unimportant. The fact that it operates for the most part along

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1/ Altaffer, American Consul, Germany, 9/24/41.

the periphery of the Continent and across many of the major lines of internal commodity movement, means that its relationship to the railways is somewhat complex and deserving of more careful study than has yet been possible.

Notwithstanding the paramount importance of the railways, it cannot be denied that the inland waterways of Europe, and particularly of Germany, supplement the railways to an important degree. In Germany, for example, the inland waterways, before the war, carried about 25 percent of all freight (by weight) and about 20 percent of coal; measured in ton-kilometers, the share of the waterways in total freight traffic was 40 percent, owing to the longer average haul by water than by rail.1/ More than half the water-borne inland traffic is carried in the highly industrialized Rhine-Westphalia region, and nearly all the rest is carried in the northwest and Elbe districts. Heavy, bulky commodities, for which speed in transport is not essential, make up most of the river and canal traffic. Coal, coke, lignite, iron and manganese-bearing ores, sand, gravel, stone, and grains accounted together for some 75 percent of the traffic in inland waterways in a pre-war year.

The development of inland waterways was prosecuted actively in Germany before the war. The volume of freight carried on the waterways was 25 percent higher in 1938 than in 1929, but only 7 percent higher for the railways. Since 1938, moreover, additional links in the system have been opened. The great Midland Canal (or system of canals, more precisely) - which completes the much-needed east-west connection between

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1/ The factual data on the German Inland Waterways were drawn largely from a study by that title prepared under the direction of Dr. J. T. Lowe of the Army Air Corps staff.

the Rhine, Elbe, and Oder - was not fully opened to through traffic until the end of October, 1938, and the Adolph Hitler canal, which facilitates the movement of coal and other products from Upper Silesia to the Oder, was opened only in December 1939. It is thus probable that the carrying capacity of the waterways is now measurably greater, both absolutely and relatively to that of the railways, than in 1938.

Unfortunately, time has not permitted study of the extent to which the waterways constitute a transport "reserve" which can be turned to when the strain on railway facilities becomes intense. That it does constitute such a reserve to some extent is apparent, but there are, or may be, important limiting factors. One of the most important of these is that of time. River and canal traffic is much slower than that by rail, and probably cannot be greatly speeded. The waterway net-work, moreover, fails to reach many regions. A more variable limit is that imposed by the adequacy of the supply of barges and motive power. Nevertheless, more intensive use of the waterways to relieve the railroads is being attempted, and their potentialities should probably be examined further. Meanwhile, attention is concentrated on the adequacy of the stock of mobile equipment available to the railways alone, since it is mainly with respect to a shortage in this realm that alternative means of transport attain significance.

II

PRE-WAR STATUS OF GERMAN RAILWAYS

The popular view that the German railway system before the war had failed to maintain either the quantity or quality of fixed plant and mobile equipment [1] has been unquestioned for so long that it now seems desirable to examine its validity.

It is usually contended that expenditures for maintenance, repair, and new equipment (See Chart I) were held down to a level that made it impossible to maintain the quantity of equipment at adequate levels, and which strongly suggests that the quality was allowed to deteriorate. In support of the contention that there was insufficient rolling stock, data are produced which show that the number of freight cars (and perhaps locomotives) in Germany (and Sudetenland) in 1938 was less than in 1929 while the volume of freight hauled was greater (See Chart II); and certain trends in operating statistics are interpreted as reflecting the deterioration of equipment.

Condition of Plant and Equipment

To support the charge of deterioration attention is called to the increase in the number of accidents (See Chart III), larger consumption of fuel per locomotive or gross ton kilometer (See Table 1), and other supposed reflections of the

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1/ See, for example, League of Nations, World Economic Survey, 1939/41, pages 30-31.

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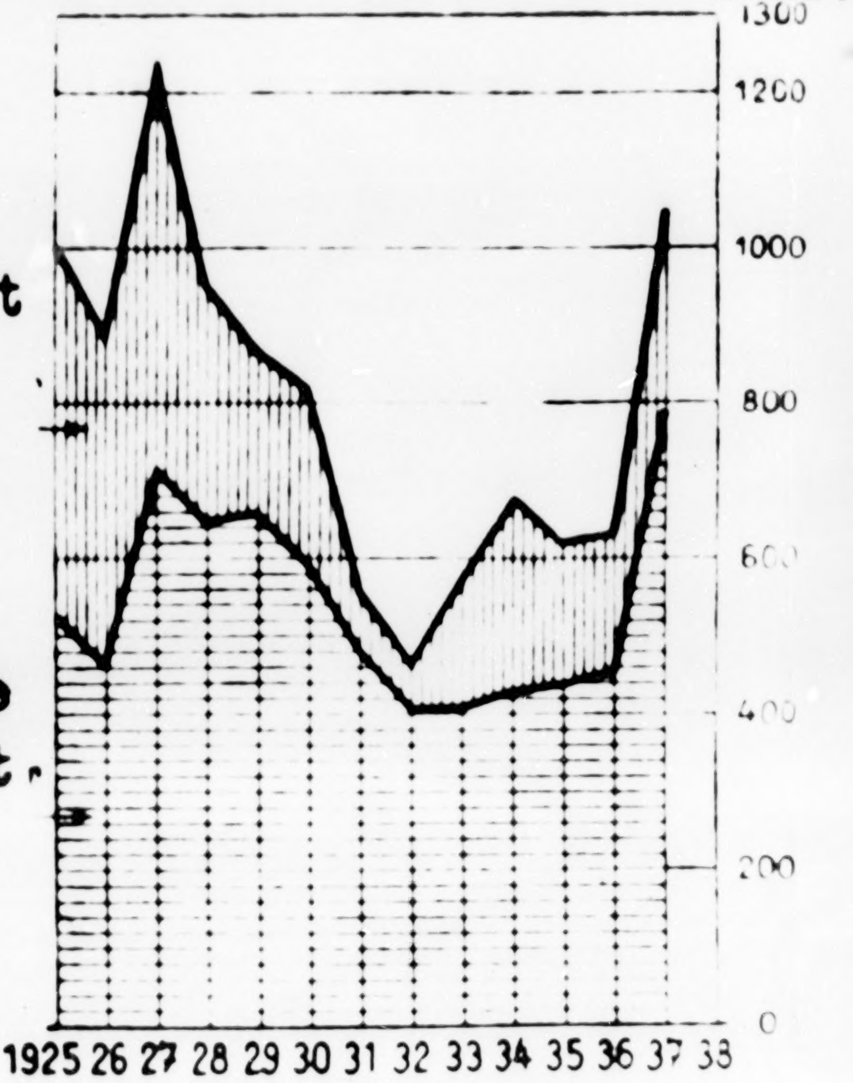
CHART I

Expenditures of German railways for maintenance of existing establishment and equipment and for procurement of additional establishment & equipment



Peyton, Colonel Bernard R. - M.A. Berlin, Germany
Report 17,117 - February 21, 1940
2462-B-53 (Restricted)

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Peyton Col. Bernard R.
M.A. Berlin, Germany
Report 17,117 - 2/21/40
2462-B-53 (Restricted)

CHART II

Load capacity of railways, and of boats on interior waterways, as compared with the volume of freight transported, 1928-1938.

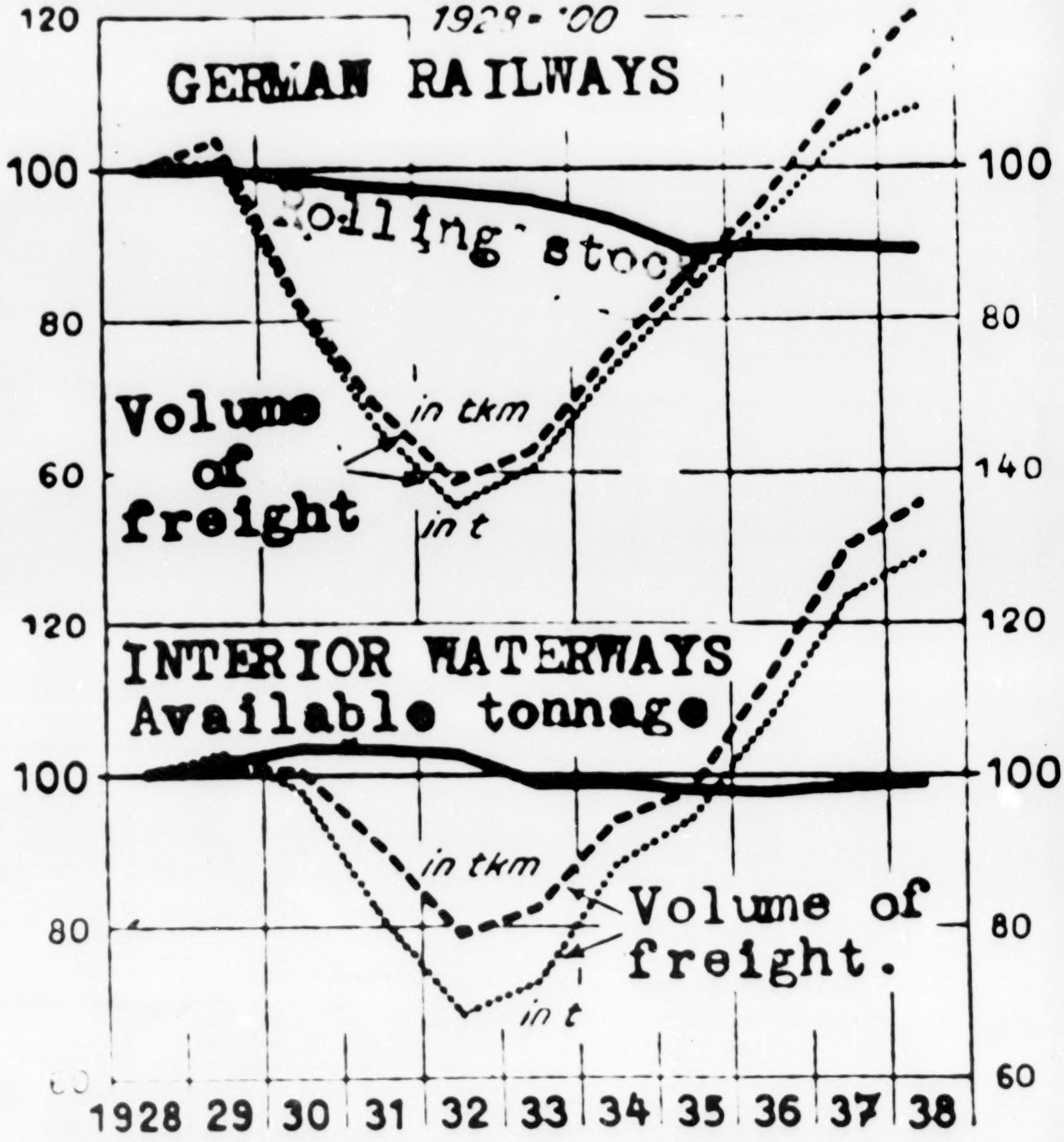
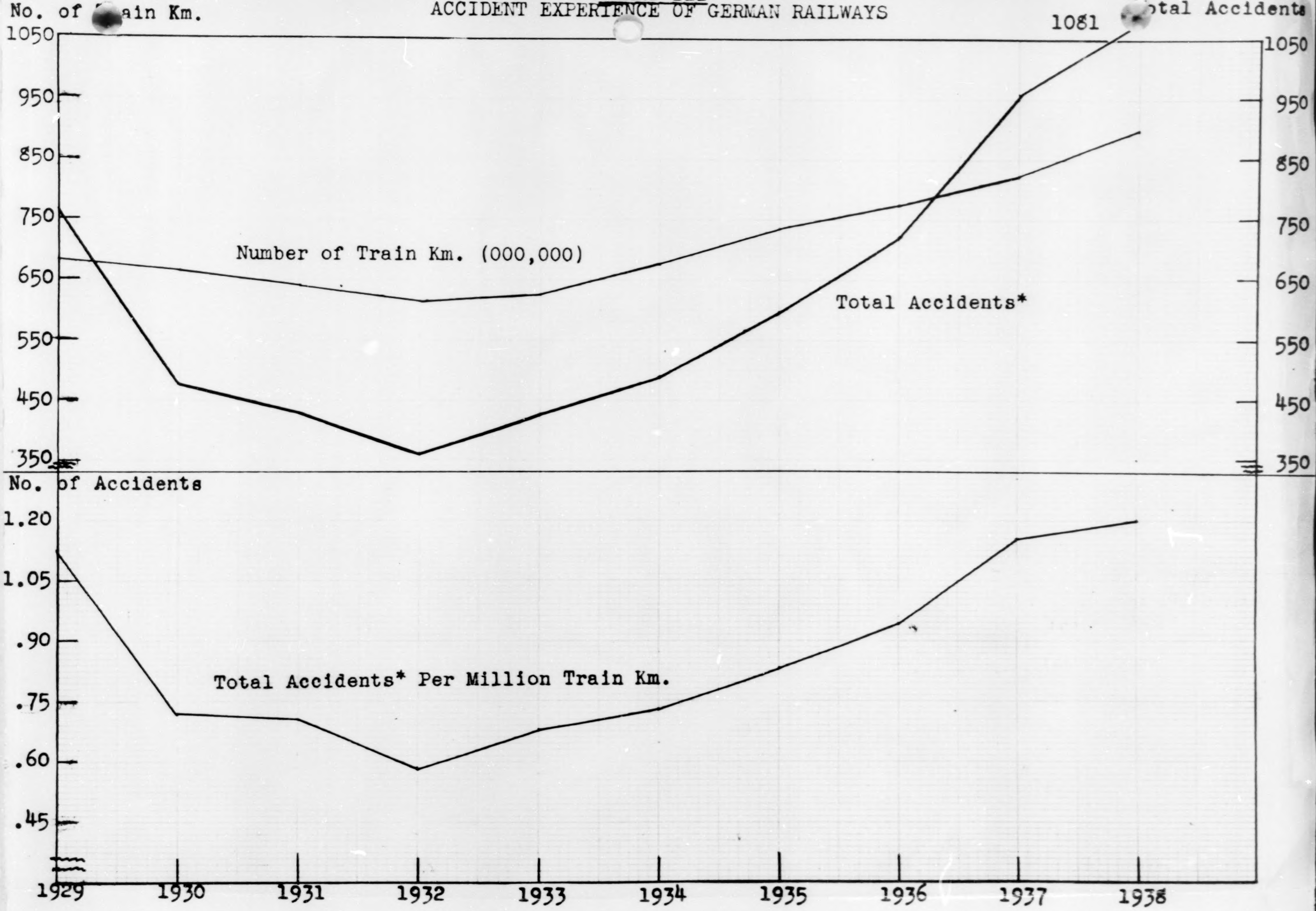


CHART III

ACCIDENT EXPERIENCE OF GERMAN RAILWAYS



* Total derailments and collisions.

poor condition and low operating efficiency of the German plant and equipment. There is a notable lack of direct technical testimony as to the bad physical condition of German railways.

Without engaging in a detailed examination of these charges, it may be noted that, almost without exception, the phenomena observed in Germany were either those of a normal cyclical character common to railway systems throughout the world, a reflection of technological and organizational progress, again common to all leading railway systems, or too small in magnitude to be uniquely attributable to the causes mentioned. The cyclical character of expenditures for maintenance, repair, and new equipment is apparent in Chart I, for example. While the total, at the end of 1937, had not reached the previous peak, it was higher than in 1929. And if allowance is made for the lower level of prices in 1937 it is by no means certain that net physical additions to capital were less, even, than at the peak of expenditures ten years before. Similarly, Chart II shows that accidents rise and fall with traffic volume, and that no significance is to be attached to the rise from 1932 on, which is no greater than would be expected in view of the rise in the volume of traffic. The changes in fuel consumption shown in Table 1 are also largely of this character, although they may be related to the more intensive use of equipment referred to below. The conclusion is inescapable that the charges of neglect of the German railways have been based on misinterpretations of data, rather than positive

TABLE I

CONSUMPTION OF COAL BY GERMAN RAILROADS

Tons	Total consumption in thousands of tons	Consumption per 1000 locomotive kilometers in tons	Consumption per 1000 kilometers of one standard steam locomotive unit in tons	Consumption per million gross ton kilometers, in tons
1929	13,603	14.22	5.85	52.87
1930	11,911	13.17	5.44	52.77
1931	11,146	13.11	5.42	55.57
1932	10,018	12.73	5.26	56.36
1933	10,377	13.24	5.42	56.13
1934	11,314	13.50	5.48	53.62
1935	12,316	13.74	5.54	53.82
1936	12,714	13.72	5.49	51.82
1937	14,051	14.20	5.63	51.10
1938	15,691	14.47	5.72	53.17

Source: Annual Reports of German Reichsbahn, Tables VIII.

evidence, and this view has been confirmed through a confidential source which has been in a position to observe German railway operations closely over a period of years. Even without such confirmation one would be inclined to doubt that the Nazis would have permitted so strategic a segment of the country's capital equipment to deteriorate measurably even though they may have attempted to economize.

Quantity of rolling stock

It is also difficult to believe that the Nazis would have permitted the quantity of rolling stock to fall to an unsafe level. There is the fact, however, that the numbers of locomotives and freight cars available to Germany were 8 percent and 10 percent smaller in 1938 than in 1929, while the volume of freight carried was 7 percent larger.

Several factors affect the interpretation to be placed on this situation. The tendency for larger cars to be built during the 'thirties did not, perhaps, have any great effect but it is none the less true that aggregate freight car capacity was somewhat higher in 1938, relative to 1929, than is indicated by comparing the number of cars. The trend toward more intensive utilization of equipment revealed in Chart II was one which was common to the United States and Great Britain (note also the experience on inland waterways, lower half, Chart II). Not only were these developments which were, in greater or less degree, also occurring elsewhere, but the Nazi regime had a particular incentive to utilize the plant and equipment of the railways more intensively, even at some increase in fuel and labor costs.

These resources were relatively plentiful, but iron, steel, and especially heavy manufacturing capacity were at a premium, In this situation there may well have been a tendency to shave railway rolling stock requirements rather thin -- perhaps too thin.

The considerations adduced above suggest that the German position as regards mobile equipment was better at the outbreak of war than popularly supposed. Calculations tending to show shortages of 70,000 to 90,000 cars greatly exaggerated the seriousness of the German situation.

It, nevertheless, seems probable, that there was no surplus railway capacity in 1939. Reported delays in train service in 1938 and 1939 indicate that the movement of troops into Austria, the Sudetenland, and Poland, and the shipment of supplies to the Westwall beginning in the summer of 1938, were sufficient burdens on the railways to cause temporary evidences of strain. In fact, there are reports of minor shortages occurring as early as 1936 and during the seasonal transport peak in the autumn of 1937. 1/

"By the beginning of 1939," according to the U. S. Military Attaché in Berlin, "all means and methods of expediting the circulating velocity of freight cars had been fully exhausted. The time consumed in loading and unloading the cars was reduced to the physical minimum on all days of the week, including Sundays."

1/ U. S. Military or Commercial Attaché, Berlin.

The Attaché also stated: "The railways have no reserve rolling stock on hand for the purpose of carrying on the present war and consequently all transportation facilities used for military purposes must necessarily reduce the facilities available to the civilian population to that extent."

The ability to curtail civilian facilities was presumably the margin on which the Germans reckoned. They probably realized, more than other countries, the possibilities in such a measure, especially in the short run. Having ventured so much on the success of Blitzkrieg tactics (rendered necessary, for example, by the impracticability of providing petroleum supplies for a long war), the Nazis perhaps felt justified in cutting the transport margin to the same pattern. A report that they had trained twice as many railway administrative officials as would be needed for domestic management has been interpreted as meaning that they planned to take over the railway plant and equipment of other countries. Nevertheless, the need for expansion to keep pace with the upward trend of traffic was recognized before the war. Early in 1939 it was announced 1/ that Rm. 3.5 billion would be spent in 1940-43 for 6,000 locomotives, 10,000 passenger cars, and 112,000 freight and baggage cars, (a ratio of 20 freight cars to 1 locomotive, in round figures). This presumably included replacement, but even so represented a substantial increase over earlier years.

1/ R. M. Stephenson, Acting Commercial Attaché, Berlin.

CONCLUSION

The German transport position was in approximate balance at the outbreak of war. No reserve had been provided to meet military demands because these were to be satisfied through the curtailment of civilian services, acquisitions of equipment in conquered territories, and, possibly, some new construction. So long as events marched according to plan there would be no German transport problem.

III

WAR DEVELOPMENTS TO BEGINNING OF RUSSIAN CAMPAIGN

Additional transport load

War developments imposed a number of added burdens on the German transport system. These fall into two categories: those associated with troop movements and other purely military operations, and those of a basic and more permanent economic character. Chief among the latter are:

(1) The railways and waterways were forced to assume much of the long-haul motor freight traffic, which was curbed by the shortage of motor fuel, and much of the traffic formerly handled by coastwise shipping. Germany, for example, has had to supply and transport coal to replace that formerly imported by Italy and other countries by water. Before the war the 6 - 7,000,000 tons of coal shipped from Germany to Italy went almost entirely by the coast-wise route. After Italy's entrance into the war Germany agreed to supply 1,000,000 tons a month, entirely by rail. More generally, the transit traffic between Germany, Switzerland, and Italy is said to have tripled during the war period. 1/

(2) The necessities of substitution resulting largely from the curtailment of overseas imports have also increased the transport load. Coal, bauxite, wood pulp, and potatoes, the basic materials from which most substitutes must be made, have had to be produced and transported in larger quantities than before the war.

(3) The extension of German control over the railways in eastern and southeastern Europe is said to have necessitated extension of trackage along with the more intensive economic exploitation of these areas, and to have resulted in a watering down of German motive power and rolling stock since the mobile equipment of these countries was generally inadequate (in quality and quantity) to meet the increased burdens imposed on their transport systems by the Germans.

1/ Germany's Rolling Stock Problem: Italy's Coal Supply Affected. From American Consul General, Basel, 6/16/41.

(4) The dispersal of industry as an air-defense measure has lengthened the haul for raw materials, including such bulky items as iron ore, coal, bauxite.

Economy of Facilities

To meet the transport problems created by the war the German authorities have attempted both to economize in the use of existing facilities and to expand the quantity of facilities available. The principal economizing measures have been: 1/

(1) Reduction in the amount of passenger service in order to free locomotives and save fuel.

(2) Restrictions on shipments of non-essential merchandise through the establishment of a strict order of priority. The smaller production of consumer goods necessitated by the shortage of materials has also diminished the transport load.

(3) Still more intensive utilization of rolling stock through such measures as permitting overloading, shortening time allowed for loading and unloading, and introducing Sunday work for freight-yard operations.

The necessity for applying these measures in full force has apparently varied with the intensity of the special demands on the transport system resulting mainly from the movement of troops into Poland and their subsequent transfer to the West; the invasion of Norway, the Low Countries, and France; and the invasion of the Balkans. Thus, there appears to have been sharp curtailment of sleeper and diner service after the outbreak of war in September 1939, followed by some restoration of service beginning in 1940. 2/ In May 1941, preparations for

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1/ Woods, Annual Economic Review, Germany, 1940.
2/ Deutsche Allgemeine Zeitung, 7-17-41; referring to a "Mitropa" report.

Russian campaign resulted in poorer passenger service in east Germany and the General Government, but elsewhere improvement in passenger service was shown. 1/ During periods of active military operations it is probable that severe measures were taken, particularly in the regions of troop movement and supply, but precise evidence as to the extent to which normal services were curtailed is not available. The fact that troop movements did not coincide with the seasonal traffic peak ordinarily reached in the latter months of the year (the brief Polish campaign is hardly an exception) is no doubt one of the reasons for German success.

Expansion of facilities

The economy measures were accompanied by expansion of transport facilities. The program for increasing the carrying capacity of the inland waterways which had been initiated in the pre-war period was apparently continued. Reference has also been made to new track laid in the east. Most important, however, has been the expansion in motive power and rolling stock resulting from both new production and accretions through conquest.

The planned expenditures for motive power and rolling stock in 1940-43 were mentioned above. One report 2/ states that this plan was abandoned at the beginning of 1940, but we have figures on expenditures for equipment in 1939 and 1940

1/ SEED # 95, 7/14/41.

2/ Deutsche Wirtschaftzeitung

which seem to indicate fairly substantial increases as compared with earlier years. Reports received from Switzerland in June 1941, however, state that considerable numbers of new (1941) coal cars had been observed passing through on the Italian run. 1/ There are also several reports of increased activity in the construction of freight cars (Cologne 2/) and locomotives (Austria, Poland). The commercial attaché in Berlin reported early this year an official statement that replenishment of rolling stock had been carried out "as far as armament tasks permitted." 3/

There is thus reason to believe that significant additions to motive power and rolling stock under German control were made through new production in Germany and occupied Europe. In 1938, when the armament program was in full swing, 305 new locomotives of various kinds were delivered to the German railways and 590 were exported, a total of 900. 4/ It has not been possible to obtain similar data for other countries, or for freight cars, although it is known that most of the countries of Europe did manufacture such equipment and some of them had a significant export trade. During the twenties, however, the Reichsbahn is said to have acquired 20,000 to 40,000 new cars

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1/ M. A., Bern, Report # 3952, 6-25-41

2/ Railway Gazette, 6-6-41

3/ Woods, R.R. Conditions in Germany, 2-25-41

4/ FRN, May 26, 1939

annually, presumably from domestic sources. 1/ While productive capacity was undoubtedly diverted to armament during the 'thirties it is understood to be relatively easy to switch back. With the adoption of lightweight construction and special designs to facilitate mass production it is not difficult to believe the report that, between September 1940 and April 1941, 14,000 new 30-ton open freight cars, (some with interchangeable axles for use on Russian gauge) had been placed in service, a production rate of 21,000 per year. 2/ The same report also stated that new freight locomotives were being built and another report 3/ stated that Belgian, French, and Dutch factories, as well as German, were making freight cars. The scattered facts available, including the data on expenditures, do not provide much basis for estimating the volume of new equipment placed in service during the 2½ years from the end of 1938 (the last year for which German figures are available) and June 1941, but 1500 motive power units and 30,000 freight cars would seem to be conservative estimates, in round figures. This, it may be noted, gives a ratio of 20 freight cars per locomotive, the same as provided in the original plans for 1940-43. (See Appendix A, Note on Rolling Stock, for detailed discussion of these estimates).

Much more important acquisitions were made in Western Europe, particularly France. The latter country, with more locomotives and freight cars per capita than Germany, constituted a readily tappable reservoir. Categorical data on the number of locomotives and freight cars taken over do not exist.

1/ C. J. Warner, Consul, Berlin, 2/18/38
2/ SEED #95, 7/14/41
3/ MEW: Economic Developments in Enemy Countries, 9/9/41.

One source 1/ states that, apart from the cars acquired as part of the transfer of the Alsace-Lorraine railways (which would not represent a corresponding net gain), Germany acquired 85,000 cars in France under the armistice and probably gained 57,000 more, a total of 142,000. This represented some 30 percent of the total French supply before the war. Acquisitions in Belgium, the Netherlands, and Denmark have been estimated at around 50,000 cars. The Germans thus gained nearly 200,000 cars at the expense of the Western European countries (see Note on Rolling Stock).

Locomotive acquisitions also appear to have been substantial, 3,000 having been acquired in France alone. 2/ This was about 1/6 of the French pre-war stock. Belgium and Holland together are estimated to have supplied more than 1,000.

In sum the situation would appear to be somewhat as set forth in Table 2. The figures are not presented with any pretense to accuracy but merely as a convenient way of drawing together the results of a hasty appraisal. It should also be noted that no deduction has been made for gasoline and Diesel powered units, which may have been withdrawn from service to save petroleum.

1/ SEED #95, 7/14/41

2/ SEED #102, August 1941

TABLE 2

GERMAN ROLLING STOCK INVENTORY, 1938 - 1941

(In round figures)

	Greater Germany and Deficit Areas 1/ (1)	Net Gains from Surplus areas 2/ (2)	New Production (3)	Available for German use, June, 1941 (1 + 2 + 3)	Percentage gain, 1938 to June, 1941
Total motive power units	3/ 42,500	4,000	1,500	48,000	13%
Total freight cars	4/ 975,000	5/ 200,000	5/ 25,000	1,200,000	23%
Number of cars per locomotive	23	6/ 50	17	25	

1/ Germany and Austria (1938); Czechoslovakia (1937); ½ Poland (1938); Hungary (1939); Rumania (1938); Yugoslavia (1938); Greece (1940); Bulgaria (1938); Italy and the neutral countries in Europe assumed to be self-sufficient.

2/ France, Belgium, Netherlands, Denmark

3/ Of which Greater Germany only, 27,400.

4/ Of which Greater Germany only, 650,000.

5/ Net gains from surplus areas rounded up from estimate of about 190,000 and new production rounded down from 30,000. The latter figure, it may be noted, would give a car-locomotive ratio of 20 to 1, which appears to be "normal" for 30-ton cars.

6/ This high ratio may be explained by the fact that it was easier to obtain cars than locomotives in conquered territories, and that these cars were of smaller average size than those of the Germans, thus permitting more to be used per locomotive.

Strain during the exceptional winter of 1939-40

The extraordinarily severe winter of 1939-40 subjected railroads in Germany and Central Europe to severe strain for a period of several weeks. Traffic over many German waterways and over the Danube route was brought to a halt. Thousands of barges were frozen in. This, and the severe cold, which increased the demand for coal, placed a burden on the railways which, waybound as they frequently were by snow and ice, they were unable to assume effectively. Both homes and industrial establishments frequently went without coal, the commodity most severely affected. The winter of 1940-41 was milder but still, apparently, rather more severe than average. It should be remembered, however, that even in normal winters traffic on the canals and navigable rivers of northern Germany and Central Europe is stopped for a few days to several weeks.

CONCLUSION

During the war period from August 1939 to June 1941 German transport facilities were adequate for most purposes and were able, without more than transitory interference with essential economic activity, to handle the demands of the several military campaigns. It is true that factors associated with the outbreak of war increased the load on the transport system, that passenger traffic and the transport of non-essential commodities had to be sharply curtailed, and that efforts to increase still further the intensity of utilization of equipment became necessary, but there is no evidence of general shortage in the sense that essential economic activities had to be suspended because of a lack of transport facilities.

The events of the winter of 1939-40 were exceptional and unforeseeable. While they demonstrated, perhaps, the inability of the German railways to assume suddenly increased burdens, their significance should not be exaggerated. In fact, it seems not improbable that, as a result of additions to equipment the amount of rolling stock in June 1941 was greater in relation to essential military, industrial, and civilian needs than in August 1939. Even the MEW concurs in this view. 1/ The gain in transport services available to Germany was made at the expense, principally, of France, Belgium, and Holland, where severe shortages of railway equipment have been reported. 2/

1/ SEED #95, 7/14/41.

2/ See reports from American Consul General, Lyons, 12/13/40, and MEW, 4/8/41.

IV

IMPACT OF THE RUSSIAN CAMPAIGN

The Russian campaign has greatly increased the load on the German transport system. The effects began to be felt even during the period of preparatory troop movements in April and May, and apparently grew in severity as the distances over which troops and supplies had to be hauled grew longer. Calculations of the extent to which the transport load has been increased have not been made, but it is evident that, as compared with the Western European or Balkan campaigns, the factor must have been substantial. Both the quantities to be transported and the distances to be traversed are much greater. The turn-around, moreover, is likely to be slower because of both the comparative scarcity of double tracking and the probable inadequacy or destruction of terminal facilities. In Germany itself the difficulties of loading, unloading, and switching under black-out conditions were no doubt intensified by the increase in British bombing raids, and the added inducement to save petroleum products perhaps reduced further the use of gasoline and Diesel powered units.

Indications of the unexpected severity of the transport problem are contained in a report[1] which stated that rolling stock taken "temporarily" for the campaign had not been returned, and that new requisitions were being made. One of the reasons is that the Russians have succeeded in destroying or removing nearly all locomotives and rolling stock, and the equipment under German control has thus had to be extended far beyond convenient limits. Winter operating conditions would be likely to slow up the turn-around, and stretch the German transport line still thinner.

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[1] American Embassy, Berlin, 8/30/41.

The impact of the Russian campaign on the German-European transport system is beginning to be reflected in a number of developments.[1] Localized shortages of goods are beginning to appear, sometimes accompanied by unusual accumulation of stocks nearer the point of origin. Consumers were warned not to rush purchases under the new (3rd) clothing ration card because retail stocks were low, owing to inadequate transport facilities. Shortages of fresh fruits and vegetables at the height of the season have been reported from Berlin, and it is said that the Bulgarian strawberry crop had to be canned on the spot because of the unavailability of transport facilities. An allied phenomenon is the increasing round-aboutness of traffic as favored routes are eliminated through being clogged by special demands or because robbed of necessary equipment. The most striking case is that of Swedish ships calling for coal at Rotterdam, where it comes down from the Ruhr by barge, because transport difficulties in the east had shortened supplies of Silesian coal at Stettin and other Baltic ports from which Swedish supplies are ordinarily shipped. Meanwhile, according to another report, coal was accumulating at pitheads in Upper Silesia. Still another reflection of car shortage is the appearance

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1/ For references and further details see Appendix B, Note on Factors Reflecting Strain.

of obsolescent or deteriorated equipment on important trunk-line runs. On the St. Gotthard run to Italy, for example, old and lightly-built Polish, Yugoslav, and Bulgarian cars are reported to have been seen in July.

On the side of positive action by the German authorities one may observe further limitation on passenger traffic and other services considered non-essential, including such minor economies as the reported limit of 3½ ounces on packages to be sent to men at the front. Efforts to utilize equipment more intensively by reducing terminal time, refusing less-than-carload lots, overloading, and so on; or to force shippers to use the waterways instead of the railroads, can also be noted. Shipments from Hamburg to points on the Elbe, Saale, Oder, and the Moravian waterways must now be made by water rather than rail (except for very small packages, perishable foods, etc.).

The accumulating evidence strongly suggests that the German transport position is now more strained than at any time since the outbreak of war except, probably, the winter of 1939-1940. Unlike the situation on that occasion, however, the present strain is unlikely to be relieved in a few weeks. Shipments to and from the areas in the east and southeast, where route facilities are relatively scarce and subject to heavy traffic for the movement of troops and supplies, appear to have suffered worst.

But while it seems clear that strain exists, appraisal of the degree of strain is difficult to make. Quantitative data are scanty and as a rule there is no base from which to measure changes in such items as are reported. It is possible, nevertheless, to obtain some clue as to the seriousness of the situation by observing the points at which it has been necessary to eliminate or curtail service. For this purpose a fairly complete catalogue of developments like those mentioned above is needed. A beginning on such a catalogue is presented in Appendix B, and will be expanded as further material comes to hand. The study of strategic military and economic routes, mentioned in the Introduction, should also assist in appraising the degree of strain.

Pending further development of this material, conclusions must be tentative. There can, however, be no doubt that the transport problem is one of the most serious confronting the Nazi regime in the economic realm today. With sustained military demands, shortages will inevitably exist, and since there is no "play" in the economy the effects on industrial activity, the standard of living, and morale are likely to be cumulative. Furthermore, attempts to alleviate the transport situation may draw organizational and material resources from employments where they can contribute more directly to military success. There is, however, danger of overestimating the significance of the difficulties that have been reported. The shortages of clothing and fresh fruits and vegetables, which are not bulky commodities, may be attributable less to a general scarcity of rolling stock than to special circumstances of a non-recurring character: the sudden clogging of certain lines by troop movements, for example. A similar explanation may account for the coal shortage at Baltic ports. In any event, the phenomena thus far observed do not, for the most part, rank particularly high in the scale of economic significance. Even coal shipments to Italy, which appear to have been reduced by the shortage of rolling stock, probably enjoy a rather low priority rating.

This situation may change if the Russian campaign continues and the winter - traditionally a difficult period for European transport - is not unusually mild. If there are major weaknesses in the German transport system they should be reflected in serious interruptions to the flow of essential commodities this winter (unless large scale military operations cease completely). The failure of such interruptions to occur would probably demonstrate the adequacy of transport facilities for almost any foreseeable contingency.

The commodities in which serious shortages are most likely to occur are coal, coke, lignite, petroleum, foods - grains, potatoes, sugar beets, meat products - building materials and fertilizers. These basic products account for much the largest share of rail (and waterway) traffic.

The difficulties encountered with respect to coal in the winter of 1939-40 have been mentioned. Last year, as a result of this experience, householders were urged to fill all available storage space during the summer, and refugees report that the same policy was pursued this year. Official reports, on the other hand, state that transport difficulties prevented the program from being carried out to the same extent as before. If the latter reports are correct, the domestic coal situation may prove to be difficult this winter. Industrial stock-piles may also be unusually low and it should be remembered that the development of synthetic oil plants and of other substitutes requiring coal or lignite as raw material or fuel has probably increased the quantities required by industry as compared with two years ago. Petroleum is rather a special case. Up to the Russian campaign the problem was mainly one of transport from Rumania to Germany. The capture of Russian Poland brought the rail route north through Hungary entirely under German control, and appears to have eased the situation considerably. This question requires further special study.

The extent to which the usual movement of food products was hampered during the harvest season is not yet known. It is believed, however,[1] that the failure of the German armies to obtain much in the way of food products, especially meats, in Russia has presented them with a food-transport problem, since shortages of both food products and freight cars make it difficult to adopt either of the two alternative methods of assuring a steady flow of supplies: accumulation of large reserves at supply depots near the front, or the maintenance of a large number of freight cars in continuous service.

The maintenance of current operations is likely to take precedence over plans for the future. It is possible, therefore, that building materials - sand, gravel, cement - for expansion of the industrial establishment will be among the products permitted to suffer as a result of the transport shortage. Should this occur it would, perhaps, have certain implications for the future.

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[1] Report on German Food Situation.

CONCLUSION

There can be no doubt that the transport situation is one of Germany's major economic problems. There are numerous evidences of strain, but it is doubtful whether the economy has been seriously injured to date. The winter should be a testing period. If the German transport position is fundamentally weak, serious interruption will occur in the movement of coal, petroleum, bulk foods, and building materials during the coming months. If, in the face of continued large-scale military operations, these do not occur one might be justified in concluding that the transport system is adequate to handle any foreseeable contingency. A curtailment of military activity however, might permit a long step to be taken during the winter in the direction of solving the transport problem.

APPENDIX A.

NOTE ON INVENTORY OF GERMAN ROLLING STOCK

Review of Conditions Prior to 1939

At the end of 1938 the amount of rolling stock available in Germany was somewhat less than in 1929. Both locomotives and freight cars were fewer in 1938 than at the end of the previous decade (See Table I).

Locomotives. Germany had 22,162 locomotives of all types in 1938 compared with 24,091 in 1929. Table II, which shows the changes in the various types of locomotives, reveals that over the period there was a decline in the number of steam locomotives which the gain in the number of electric locomotives and in yard engines failed to offset.

The proportion of steam locomotives awaiting or undergoing repairs had been sharply reduced by the end of 1938 from the figure prevailing in the depression years. (This parallels experience in the United States.) For instance, in 1932, when the volume of traffic had fallen greatly, nearly one-quarter of the steam locomotives of the German Reichsbahn were listed as awaiting or undergoing repairs. This high proportion would not necessarily indicate a condition of general bad repair for German locomotives, but rather that as a consequence of the reduced demand, repairs were not being made so fast; unserviceable locomotives piled up in "graveyards". As the traffic volume increased, these locomotives were put back into service, and by the end of 1938 only 13% of the steam locomotives were awaiting or undergoing repair. This is not necessarily an abnormally low percentage; although lower than in 1929, it may not indicate, as has been argued, that normal repair was not being carried out owing to the need to keep locomotives in operation. It may have been a carryover effect of repairs made in earlier years.

A noteworthy development in the inventory of German rolling stock is the increase between 1929 and 1938 of the number of rail motor cars (Triebwagen), particularly those with Diesel power. These were used primarily for local and suburban passenger traffic; their importance lay in freeing locomotives for through-train service. Moreover, for short-run traffic, they probably were more efficient users of power than heavier types of movers. In 1929, the German Reichsbahn had 1,151 such rail motor cars; at the end of 1938 there were 2,059 in the Altreich and Sudetenland. (It is not known how many were in the Sudetenland alone.)

Cars. The number of railroad cars owned by the German Reichsbahn likewise declined during the 1930's. At the end of 1938, there were only about 678,000 railroad cars of all types, while in 1929, Germany had over 745,000 (Table I). The chief reduction between these two periods was in freight cars (from 661,000 to 595,000), especially in the number of open cars. This category includes gondolas, hoppers, and flat cars, and it may be noted that such cars can be built more readily than box cars.

At the end of 1936, the average age of German freight cars was placed at 20 years; it is stated that, with care, a maximum age of 40 years may be reached.

During the depression years there was undoubtedly a great surplus of rolling stock, but by 1936, it is said, the need for expanded railroad capacity began to be felt. In that year, it is reported, there were times when all demands of shippers could not be met smoothly; and during the 1937 harvest period there is said to have been a noticeable shortage of transportation facilities. The volume of freight carried by the German railroads had been increasing since 1933, while the amount of rolling stock had continued to decline. Additions of freight cars did not keep pace with retirements (Table IV) and the tendency to build cars of somewhat greater load capacity (30 tons) was probably not sufficiently marked to make a great difference. The average capacity of a German freight car is about 22 tons.

Developments Since 1939

The need to provide for a considerable expansion, over a period of years, in the capacity of the German Reichsbahn, was recognized before the outbreak of the war. It was announced early in 1939 that in line with the development of the Four Year Plan, a program of construction of railroad equipment involving the expenditure of 3,500,000,000 Reichsmarks would be undertaken. It was to include the addition of 6,000 locomotives, 10,000 passenger cars, and 112,000 freight cars. This, it will be noted, represents 20 freight cars to one locomotive (in round figures, and with allowance for passenger engines), compared with a ratio of 27 to 1 on the basis of equipment held at the end of 1938. It may be noted further that if all the new cars were of the 30-ton size, the carrying capacity per locomotive represented by the two ratios would be almost exactly the same (30 x 20 = 600 tons; 22 x 27 = 594 tons).

Subsequently, according to a statement in the *Deutsches Wirtschaftszeitung*, this plan was abandoned. Nevertheless, expenditures of the German Reichsbahn for new equipment in 1939 and 1940 rose considerably above the level of earlier years. (Table IV.)

In the sections below an effort has been made to estimate the position of the German Reichsbahn in respect to locomotives and freight cars, based on the best available evidence.

Locomotives. As a result of new production and acquisitions from other countries, the number of locomotives held by Germany in June, 1941, is estimated to have been 27,700. These were obtained as follows:

On December 31, 1938, Germany (excl. Sudetenland) held		22,150
New Production, 1939-June, 1941	1,500	
Acquired from:		
France	3,000	
Belgium	700	
Netherlands	450	
Total, June, 1941		27,700

The Sudetenland was excluded from the figure for the end of 1938, on the ground that the acquisition of 888 locomotives at the time that territory was taken over was only enough to serve the needs of that area. Similarly, subsequent acquisitions of locomotives in areas where there was apparently no surplus capacity (Bohemia-Moravia, Poland, the Balkans, etc.) were not considered as additions to the numbers available to Germany. It is known that Germany has, in fact, had to send locomotives and other rolling stock of her own into some countries in order to keep them functioning at a level consistent with her demands upon them. (See below.) France, the Netherlands, and Belgium, on the other hand, are believed to have had a considerable surplus of rolling stock, especially in relation to their reduced needs after German occupation.

It has been assumed that all of the new production since 1938, and the acquisitions from France, Belgium, and the Netherlands constitute net additions to the German supply of locomotives, since the destruction of rolling stock, particularly of locomotives, during the campaigns undertaken to June 1941, probably was not very great in relation to the numbers acquired. Moreover, during this period, it is unlikely that any appreciable number of locomotives was retired; it is estimated that in 1938 only 81 were scrapped. (Table II.)

The total of 27,700 locomotives arrived at as the number available to Germany must be qualified by the knowledge that some, perhaps all, of the Diesel-powered yard locomotives (shown in Table I as "Small") as well as the oil-burning "Triebwagen", or self-propelled cars, have been withdrawn from use in an effort to conserve oil. Consequently, some of the steam engines would have to be used for yard work and - except to the extent that such services have been curtailed - for the local haulage of passengers formerly served by Triebwagen, and would not be available for the general work of the railroad.

New Production. The figure of German production was derived in the following manner. Table II shows the number of units of locomotives delivered to the German railways, and Table IV shows their cost for a series of years. The total expenditures of the Reichsbahn for rolling stock (new and replacement) is known. For a number of years the proportion which expenditures for locomotives represented of the whole was about 20%, but in 1938 it jumped to 30%. This latter proportion was assumed to hold true in 1939 and 1940 in view of the heavy program of locomotive building which had been planned. While this program had to be scaled down, it seemed reasonable to suppose that at least as large a share of the greatly increased expenditures had gone for locomotivds as in 1938.[1] An average cost of locomotives was derived from the unit and value data and this applied to the estimated expenditures for locomotives gave the number of locomotives bought during the years 1939 and 1940. The first six months of 1941 were taken as one-half the 1940 figure. The resulting figure of 1,420 was then rounded up to 1,500.

There may be some question as to the capacity of the equipment industry to build such a large number of locomotives during this period. The number of establishments had been reduced from 22 at the close of the last war to 9 in 1939; two plants were taken over with Czechoslovakia and one in Austria. Reductions in plant numbers probably did not involve a comparable reduction in capacity, however, since it is likely that the smaller and least efficient plants were closed down. It is also possible that the decline reflects the conversion of locomotive plants to the production of tanks etc., and that these could be reconverted. In 1938, Germany produced 895 locomotives of which 590 were exported. On balance it would appear that the rounded figure of 1,500 given for new production in Greater Germany for 2½ years would not be too high.

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[1] It is possible that this is not wholly justified, since the figures prior to 1939 are for Germany alone, while the total expenditures for 1939 and 1940 include amounts spent for rolling stock for the Austrian railroad. The same proportion of expenditures may not have applied in the case of Austria.

France. This figure was taken from MEW: SEED, No. 102. It represents 16% of the number of locomotives in France in 1940.

Netherlands. In 1939 the Netherlands had 1,124 locomotives, of which 901 were steam. It has been stated that the Germans did not take any electric locomotives from the Netherlands, since they were all Diesel-electric. It is believed that the Germans took about half the Dutch rolling stock; applying this percentage to steam locomotives gives the figure used.

Belgium. In 1939, Belgium had 3,593 locomotives. These were all steam; the amount of electrified track in Belgium is negligible. Since it is probable that the Germans have exploited Belgian industrial resources more intensively than those of the Netherlands and hence have had to provide more transport facilities, it was decided to apply the French proportion with a slight upward adjustment because of the greater possibility of Belgium's being served by the inland waterway system.

Freight Cars. Whereas on December 31, 1938, it is known that Germany had only 595,000 freight cars, it has been calculated that as a result of requisitions from other countries and from some amount of new production, her holdings in June 1941, were more than

800,000. In arriving at this figure, no attempt was made to allow for destruction from war damage during the campaigns prior to June 1941, since the estimates of acquisitions are too approximate to justify such refinement. The figure of 15,000 dropped off in rounding the total to 800,000 (compare table below) may take care of this factor. It may be noted, however, that such losses probably were greater in the case of freight cars than in that of locomotives, partly because of their restricted mobility, and partly because of their less durable construction.

On December 31, 1938, Germany (excl. Sudetenland) held		595,000
New Production, 1939-June, 1941	30,000	
Acquired from:		
France	142,000	
Belgium	34,000	
Netherlands	13,500	
Denmark	500	
Total, June 1941		815,000

The 23,000 freight cars turned over by Czechoslovakia with the loss of the Sudetenland are excluded on the same grounds as for locomotives.

New Production: This figure was estimated in the following manner. It is reported that 14,000 new 30-ton capacity freight cars were placed in service between September, 1940, and April, 1941. If this same rate of production is assumed for the whole two-and-a-half year period from the end of 1938 to June, 1941, a total of 70,000 freight cars would have been added or at the rate of 27,600 a year.

This would appear to be over-large; during the years between 1913 and 1928 Germany added 20-40,000 new freight cars a year; between 1928 and 1938 additions at the rate of 1,400-3,000 a year were not even enough to take care of necessary replacements, as can be seen from Table III. During this latter period the capacity of the freight car construction industry in Germany was greatly reduced, and while it would not be difficult to re-convert some plants diverted to other types of production, (mainly armament) the expansion indicated by such an annual production as 27,600 cars would seem unreasonable, in view of other demands.[1] At the same time, the amount which could be spent for the purchase of freight cars by the German Railroad, as indicated in Table IV (balance after estimated deductions for locomotives assuming no passenger car or Triebwagen purchases), during the period under examination (assuming one-half the 1940 figure is applied to the first half of 1941) was 674.9 million Reichsmarks. If 70,000 freight cars were added during this period, the average cost would have been only about 10,000 Reichsmarks, which seems far too low. It should also be kept in mind that the ambitious program announced in 1939

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[1] It has been reported that Belgian, French and Dutch factories as well as Peruvian are engaged in the manufacture of freight cars. (MEW: Economic Developments in Enemy Territories to the end of August, 1941.) The capacity of the industry in these countries is not known.

This would appear to be over-large; during the years between 1913 and 1928 Germany added 20-40,000 new freight cars a year; between 1928 and 1938 additions at the rate of 1,400-3,000 a year were not even enough to take care of necessary replacements, as can be seen from Table III. During this latter period the capacity of the freight car construction industry in Germany was greatly reduced, and while it would not be difficult to re-convert some plants diverted to other types of production, (mainly armament) the expansion indicated by such an annual production as 27,600 cars would seem unreasonable, in view of other demands.[1] At the same time, the amount which could be spent for the purchase of freight cars by the German Railroad, as indicated in Table IV (balance after estimated deductions for locomotives assuming no passenger car or Triebwagen purchases), during the period under examination (assuming one-half the 1940 figure is applied to the first half of 1941) was 674.9 million Reichsmarks. If 70,000 freight cars were added during this period, the average cost would have been only about 10,000 Reichsmarks, which seems far too low. It should also be kept in mind that the ambitious program announced in 1939 called for only 112,000 freight cars over a four year period.

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[1] It has been reported that Belgian, French and Dutch factories as well as Peruvian are engaged in the manufacture of freight cars. (MEW: Economic Developments in Enemy Territories to the end of August, 1941.) The capacity of the industry in these countries is not known.

Another point which might be taken into consideration is that throughout the 'thirties, a fairly constant relationship obtained between the number of locomotives and the number of freight cars:- about 27.5 cars to one locomotive. At this rate, if Germany indeed did have 27,600 locomotives in June, 1941, she would have needed only 760,000 freight cars. Actually, if our assumptions on the number taken from other countries are correct, she had 785,000 without any new production at all. Changing traffic conditions and possibly the smaller size of confiscated cars may well have made this "excess" necessary, but the indications are that a new production of 30,000 freight cars in the period under consideration is more nearly correct than 60,000 or 70,000. On the basis of 1,500 new locomotives this would represent a ratio of 20 to 1, exactly the ratio planned in the 1940-43 program.

Denmark: It has been stated that 500 Danish freight cars which had been sent to Germany to take delivery of coal had not been returned by March 20, 1941.

France: In addition to the cars taken over with the Alsace-Lorraine railroads (which are not considered a net addition here) the French were forced to hand over 85,000 cars for incorporation in the stock of the German Reichsbahn. As of October, 1940, it was reported that an additional 57,000 freight cars of the French National Railways had gone into Germany in the course of operations and not returned. The total of these two items (142,000 cars) represented about 1/3 of the French stock of freight cars in 1940 and probably would be a minimum estimate of the number taken by the Germans. Other estimates place the figure higher.

Netherlands: In the case of the Netherlands the same percentage (50%) was applied in the case of freight cars as for locomotives.

Belgium: It is considered probable that relatively fewer cars were taken from Belgium than from the Netherlands and that requisitions probably approached the French rate more closely. Hence a figure of 30% was applied to the 114,000 cars owned by Belgium in 1940.[1]

A Note on Deficit Areas

In the calculations undertaken above, it was considered that France, Belgium, the Netherlands, and Denmark were areas in which a surplus existed in rolling stock above minimum essential needs. In other areas which Germany has occupied or drawn into her economic sphere, there is presumed to be either a state of balance or a deficit which Germany has had to make good.

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[1] Although the Swiss have complained that cars sent into Germany for goods have not returned, no allowance has been made for this in the calculations.

The additions to German rolling stock outlined above are thus not to be considered as net gains, but as the means whereby Germany has been able to handle an increased transport load, including that of the deficit areas.

For instance, in Austria prior to 1938, rolling stock, although generally held to be inferior in relative volume and state of repair to the German, was barely adequate for the demands made upon it. The desire of the Germans to exploit this country as an industrial resource forced the German Reichsbahn to undertake construction of track and facilities, and to supply additional rolling stock for the "Ostmark" even before the outbreak of war; this process was presumably intensified after the war began.

The amount of rolling stock which fell into German hands when Bohemia and Moravia became the "Protectorate" was hardly more than was needed for the requirements of that area. The demands of the war and the central location of Czechoslovakia have put a heavy burden upon the railway system of that country. There can have been no surplus with which to meet new demands elsewhere.

In Yugoslavia, the amount of rolling stock had been declining for some years prior to the war and it is reported that what there was was not in good repair. Destruction of rolling stock during the Balkan campaign probably was relatively greater here than in the Western campaign in the surplus countries of Belgium and France. Yugoslavia must be considered a deficit area.

In Hungary, conditions were about in balance before the acquisition of the additional territory from Rumania and Slovakia. At the present time this country, too, probably is deficient in rolling stock of its own.

Poland lacked enough rolling stock even before the war. It has been estimated that 40,000 freight cars were acquired by Germany in the Government General, but that this was not enough to meet the needs of even this section of Poland.

Greece and Rumania likewise were poor in respect to rolling stock, and, in default of special study, one may assume a priori that Italy had no surplus. The Spanish Civil War left that country seriously depleted. It has even been reported that some of the equipment formerly used on the de luxe Orient Express from Paris through Central Europe to the Balkans has been turned over to the Spaniards, but it is not to be supposed that the Germans had contributed much to easing the Spanish position.

The demands of all these countries under present circumstances cannot be estimated with any degree of accuracy, but the facts here reviewed should be kept in mind in appraising the burden on German rolling stock.

TABLE I

Rolling Stock of the German Railways

At the End of the Year

	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938*
Locomotives:										
Total, including electric	24,091	23,688	22,194	21,489	20,669	21,105	21,656	21,792	21,838	23,050
Steam	23,698	23,271	21,746	21,002	20,030	19,887	20,176	20,187	20,166	21,278
Of which:										
Under repair:-	4,373	3,985	4,359	5,107	4,553	3,680	2,989	3,107	2,791	2,745
Percent	18.5	17.1	20.0	24.3	22.7	18.5	14.8	15.4	13.8	12.9
In active use:-	19,328	19,286	17,397	15,895	15,477	16,207	17,187	17,080	17,375	18,533
Rail Motor Cars:										
Total	1,151	1,198	1,231	1,255	1,334	1,384	1,561	1,688	1,762	2,059
Of which Diesel -	- Data not given for these years -					117	261	326	386	473
Cars										
Total	745,379	741,608	735,954	726,991	704,507	674,460	677,243	675,744	673,686	701,545
Of which:										
Passenger	63,641	65,429	65,632	64,413	61,328	59,925	60,343	60,339	60,629	63,093
Baggage	20,990	21,337	21,174	21,063	20,771	20,407	20,303	20,045	19,969	20,473
Freight	660,748	654,842	649,148	641,148	641,515	594,128	596,597	595,360	593,088	617,979
Of which -										
Open	417,580	412,203	407,485	400,824	387,244	365,914	367,879	367,130	365,576	380,993
Closed	229,950	228,794	227,240	226,124	220,279	212,470	212,269	211,192	209,420	218,047

*Included are 888 locomotives (classification unknown), 23,000 freight cars, and 2160 passenger and mail cars of the Sudetenland.

Source: 1929-32 - Annual Report Deutches Reichsbahn 1932, Tables V - VII
1933 - " " " " 1933, " " "
1937-38 - " " " " 1938, " " "

TABLE II

Changes in Supply of German Locomotives

	Steam		With Gas or Oil Motor		Small		Electric		Total		Deliveries to German Railways	Estimated Rate of Replacement*
	Number at Year End "A"	Annual Change "B"	"A"	"B"	"A"	"B"	"A"	"B"	"A"	"B"		
1929	23,698	-	3	-	2	-	388	-	24,091	-	8	-
1930	23,271	- 427	3	0	15	+13	399	+11	23,688	- 403	-	-416
1931	21,746	-1,525	2	-1	47	+32	399	0	22,194	-1,494	92	92
1932	21,002	- 744	2	0	85	+38	400	+ 1	21,489	- 705	106	105
1933	20,030	- 972	3	+1	196	+111	440	+40	20,669	- 820	156	116
1934	19,887	- 143	3	0	754	+558	461	+21	21,105	+ 436	193	172
1935	20,176	+ 289	3	0	993	+239	484	+23	21,656	+ 551	175	**
1936	20,187	+ 11	2	-1	1,082	+ 89	521	+37	21,792	+ 136	156	108
1937	20,166	- 21	2	0	1,127	+ 45	543	+22	21,838	+ 46	175	153
1938***	21,278	+1,112	1	1	1,200	+ 73	571	+28	23,050	+1,212	305	81

* Deliveries to German Railways assumed to include only steam or electric locomotives, compared with annual net change in supply of these two classes.

** Additions of 137 more locomotives than given as produced probably represent those acquired in the Saar.

***Includes 888 unclassified locomotives from Sudetenland.

Source: Number of Locomotives, Table I.
Deliveries, Foreign Railway News, 5/26/39, p. 161, taken from *Frankfurter Zeitung*, 4/7/39

TABLE III

CHANGES IN SUPPLY OF GERMAN RAILROAD CARS

	1930	1931	1932	1933	1934	1935	1936	1937	1938
Passenger	+ 1788	+ 203	-1219	-3085	-1403	+ 418	- 4	+ 290	+2464 *
Baggage	+ 347	- 163	- 111	- 292	- 364	- 104	- 258	- 76	+ 504 **
Freight	- 5906	-5694	-7633	-19107	-28280	+2469	-1237	-2272	+24891
Open	- 5377	-4718	-6661	-13580	-21330	+1965	- 749	-1554	+15417
Closed	- 1156	-1554	-1116	- 5845	- 7809	- 201	-1077	-1772	+8627
Total	- 3771	-5654	-8963	-22,484	-30,047	+2783	-1499	-2058	+27,859

*-From Sudetenland: 2160; net +304

**-From Sudetenland: 23,000; net + 1891

TABLE IV

EXPENDITURES FOR EQUIPMENT ON GERMAN RAILWAYS

(Millions Reichmarks)

	Spent for Locomotives	Total	For Other than Locomotives	Percent for Locomotives
1929	10.1	203.7	193.6	5.0
1930	-	172.8	172.8	-
1931	17.9	103.7	85.8	17.3
1932	16.7	69.6	52.9	24.0
1933	20.5	88.5	68.0	23.2
1934	24.9	126.5	101.6	19.7
1935	29.9	130.3	100.4	22.9
1936	24.0	125.2	101.2	19.2
1937	29.1	138.1	109.0	21.1
1938	62.0	203.9	141.9	30.4
1939	100.0*	333.2#	233.2	30.0**
1940	125.9*	419.7#	293.8	30.0**

Source: Amount spent for locomotives - Foreign Railway News, 5/26/39. Figures originally appeared in the German press and may not be comparable with those for "Total" expenditures.
Total Amount spent - Annual Reports of the Deutsches Reichsbahn, "Beschaffung Ganze Fahrzeuge", Tables XII.
Other items calculated.

* Calculated by applying percentage to total.
**Previous figure carried forward.
# Data given in report from Woods, Berlin, 6/11/41; his number 2611. This figure is not strictly comparable to those of previous years because it covers expenditures for the Austrian railroad as well as for the German, and because there is an undeterminable amount included for depreciation reserve. In the absence of other, better data this must be accepted and used with qualifications.

TABLE V

	Average number of pairs of wheels per train for freight service	Average net weight of 1 freight train (tons)	Average capacity per 1 pr. of wheels (tons)
1929	77	304.68	8.07
1930	72	268.84	8.09
1931	69	251.58	8.10
1932	68	241.16	8.11
1933	70	253.51	8.13
1934	74	272.35	8.16
1935	74	275.03	8.19
1936	75	283.34	8.20
1937	76	236.39	8.20
1938*	73	291.72	8.15

* Including Sudetenland for which separate data are not available. The interruption of the upward trend probably is due to this fact since conditions in the Sudetenland probably were closer to those in Austria than to those in Germany: the only comparable figure reported for Austria gives an average of 59 pairs of wheels per freight train and presumably the other figures would be similarly low.

Source: Annual Reports of the German Reichsbahn, Tables II.

Appendix B

NOTE ON FACTORS REFLECTING TRANSPORT STRAIN:

CATALOGUE OF EVIDENCE

There is presented herewith a catalogue of the main items of evidence thus far gathered which reflect strain in the transport system. It is believed that careful search for, and systematic organization of, such items is essential if intelligent measurement of the degree of strain is to be attempted. By observing the type, location, and sequence of developments, a "feel" for the situation may be developed which will permit sound quantitive judgments to be made. The present arrangement is experimental and tentative.

Localized Shortages

Date		Location
	Coal	
Spring and summer, 1941	Policy of preceding year of forcing consumers to store coal for winter not carried through to same extent this year, owing, apparently to transport strain accompanying troop movements in preparation for Russian campaign.[1] (Buxton reports indicate that the policy was carried out, but not necessarily to same extent as before.)	?
July 1	Special cheap freight rates enjoyed by German coal-exporting regions extended on July 1, 1941, to anthracite, coke, and briquettes shipped from Lorraine by rail to points on Danube. May indicate strain in transport of Silesian coal.[2]	West-East

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[1] Report 22246, C. A., Berlin, 9/13/41

[2] Railway Gazette, 8/22/41 (Naz. Zeitung, Essen, July 8.

Coal (Cont'd)

Date		Location
Sept. (early)	Coal accumulating at pitheads in Upper Silesia due to scarcity of freight cars.[1] One of principal sources of coal for export to Italy, Switzerland, and Sweden.[2]	Silesia
Sept. (Middle)	Steam coal particularly scarce at Baltic ports. Bottleneck said to be movement by rail from Silesia to Stettin and neighboring ports.[3]	Baltic ports; Silesia
Sept. (Middle)	Deliveries to Italy and Switzerland said to have been reduced, as well as to Northern Countries.[4] Number of trains per day remains the same (60) but cars per train reduced from 55 to 35-45. Affects Belgian coal particularly. Some Swiss observers estimated reduction in rail movement to Italy (mainly coal) at 20-30 percent.[5] Other reports say deliveries maintained if Swiss and Italians call for coal at Rotterdam by water. [6]	Italy, Switzerland
	Some manufacturers have already been informed that they will have to get along with lower supplies. [4]	?
	Open cars for sugar beets compete with coal-loading needs; start of shipping season expected to create stringency in open car situation in next 10 weeks. [7]	

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[1] SEED #104, 9/10/41, Par. 62.

[2]

[3] SEED, #105, 9/17/41, Par. 75.

[4] Report 22246, C. A. Berlin, 9/13/41.

[5] Report from American Consul General, Basel, 9/16/41

[6] Domeratzky notes.

[7] SEED #104, 9/10/41.

Food

Date		Location
July (early)	Shortage of many items in Berlin due to lack of transport. Perishable foods, such as strawberries, given priority, so lack of other foods quite marked. 1/	Berlin
	Bulgarian strawberry harvest could not be brought to German markets on time, as in previous year; canned on the spot. 2/	Bulgaria
July (middle)	The District organization leader stated recently (according to the Konigsberger Allegemeine Zeitung of 7/27/41) that the vegetable shortage was due not only to the bad season but also to transport difficulties in Konigsberg. 3/	Konigsberg
Summer	Shortage of fruit and vegetables at height of season, especially in Berlin, caused by transportation bottleneck in the East due to military demands for rolling stock. Imported produce, mostly from Italy, easier to obtain, perhaps because brought back in returning coal cars. Domestic beans practically unobtainable after early August. Shops attribute these shortages to transport. 4/	Berlin and the East
Fall (early)	Freight car shortage reported from Spain, Italy, Belgium, Bulgaria, for transporting sugar beet crop - most important seasonal bulk movement of food in Europe. 5/	Spain, Italy, Belgium, Bulgaria
	Food shipments from east and southeast have been delayed, causing shortages which cannot be explained in terms of either harvests or military demands for food. 6/	East and southeast
September	Swiss Railway Administration have informed Berlin that shortage of freight cars in Switzerland will necessitate 15% reduction in Swiss fruit shipments to the Reich. 7/	General

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1/ M. A., Berlin, 7/10/41, Report #18,459.

2/ Ernest Zaugg, Chr. Sci. Mon., 11/1/41.

3/ British Embassy: News of Hitler's New Order, p. 2.

4/ Report 22246, C. A., Berlin, 9/13/41.

5/ MEW: Economic Developments in Enemy Countries, 9/9/41.

6/ W.L.M.

7/ American Consul General, Basel, 9/16/41.

Date		Location
	Clothing	
August	Consumers warned not to rush purchases under new (3rd) ration card in preparation as necessary retail stocks were depleted owing to inadequate transport facilities.1/	Cities?
	Building Materials	
Winter 1940-41	Other difficult problems to be faced by German lumbermen in 1940/41 were those of the growing scarcity of labor and increasing transportation difficulties, especially with regard to the removal of logs.2/	?
Spring(?)	Transport shortage prevented usual accumulation of reserves of heavy building materials.3/	General
Forced Shifts in Normal Traffic Pattern		
July	Holland is counting on getting feed grains from the Balkans according to the leader of the Dutch Agricultural Front speaking over Hilversum radio, 7/3/41.4/	Balkans-Holland
August	Increased volume of shipping noted at Rotterdam compared with April; mostly iron ore (from ? to ?).5/	Rotterdam
	Swedish ships have had to call at Rotterdam for coal, where supplies are more plentiful than at customary Baltic ports.6/	

1/ Notes by Domeratzky.

2/ Report from Woods 10/11/41.

3/ Armstrong notes.

4/ British Embassy: Hitler's New Order, p. 6.

5/ SEED #105, 9/17/41.

6/

Date		Location
	Forced Shifts in Normal Traffic Pattern (cont'd)	
	Freight shipments from Hamburg to places on Elbe, Saale, Oder, and on Moravian waterways, can no longer be sent by rail, but by water only. (Exceptions for small packages, perishable foods.)1/	Hamburg-Eastern Germany
September	Attention strongly drawn in Germany to importance of maximum use of coastal shipping services, mainly Baltic, to ease burden on German railways.2/	Baltic coast
September	Increased shipping activity at Delfzil and Emden probably traceable to navigational difficulties in Baltic.3/	North Sea - Baltic
	General	
July	Freight car shortage and congestion reported from Bulgaria.4/	Bulgaria
September	Reports of continued car shortage in Bulgaria and of negotiations between Bulgarian and German railways for hire of German care for both internal Bulgarian traffic and exports.5/	Bulgaria
Inadequate Maintenance and Use of Inferior Equipment on important lines		
May, 1941	German rolling stock moving to Italy via Switzerland showing increasing signs of deterioration due to both neglect and overloading.6/	Italy, Switzerland
	Reported to Berlin in May that railways in Protectorate could not continue to operate under present pressure unless additional maintenance and repair were undertaken.7/	Bohemia-Moravia

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1/ Amer. Consul, Hamburg, 9/24/41.
2/ SEED #106, 9/25/41.
3/ SEED #107, 10/1/41.
4/ SEED #81, 7/30/41.
5/ SEED #105, 9/17/41.
6/ Notes by Domeratzky
7/ SEED #101, 8/20/41.

Inadequate Maintenance and Use of Inferior Equipment on important lines (cont'd)

Date		Location
July	Old, light weight, Polish, Yugoslav, Bulgarian freight cars seen on double-tracked St. Gotthard run to Italy. 1/	Italy

More Intensive Use of Equipment

August 1941	Owing to army requirements, railway cars running inside Germany can be loaded to one ton over capacity (poor roadbed conditions may prevent this elsewhere), and a special appeal is made to unload trucks immediately, even working on Sundays. 2/	General
Sept.	Traders reminded of heavy demand for cars and asked to speed up turn-around. 3/	General

Curtailment of Services

July	For week July 16-21 passengers leaving stations in Westphalia (important coal center) for stations in south, north, and central Germany were required to obtain special permits and all journeys of less than 150 km. were forbidden. 4/	Westphalia
July (early)	Passenger traffic reduced as much as 75% in some instances (in Berlin?). 5/	Berlin ?

Personnel

April	Considerable numbers of railway men in army released in April, and call-up of others postponed. 6/	General
Sept.	Staff position on German railways becoming more difficult. Railway workers still being sent to Front from Western Germany; hours of those left behind being increased to 12 per day. 6/	General West-East

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1/ Notes by Domeratzky.

2/ Landesbauerschaft Oestprusen, Aug. 23, 1941.

3/ SEED #105, 9/17/41.

4/ Railway Gazette, 8/22/41, p. 197.

5/ M. A. Berlin, 7/10/41, Report #18,459.

6/ SEED #106, 9/25/41.

SECRET

COORDINATOR OF INFORMATION

Central European Section

GERMAN MORALE

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SECRET

GERMAN MORALE

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GERMAN MORALE

1. From 1933, and even before, German morale was prepared for the responsibilities and hardships of offensive military action. The advent of the National Socialist regime was accompanied by the institution of elaborate efforts to control and direct public opinion to this end.

2. Nazi propaganda theorists have realized that during a modern total war efforts to control public opinion work within narrow limits: the real underlying factors remain, as elsewhere, the success, actual and prospective, of military operations and the hardships and discomforts borne by the people.

3. From the outbreak of hostilities in 1939 until June 1941 the strength of German morale was unquestioned. This may be regarded essentially as a consequence of the great German victories and, perhaps more important, the feeling that total victory was certain and within sight.

4. The prolonged and difficult campaign in the East has affected German morale in the following respects:

(a) Civilian supplies of all kinds have been diminished due, in part, to the pressure on transport facilities and on the labor supply.

(b) British bombing has been intensified.

(c) Man-power losses have been sufficiently heavy to impress themselves upon the public.

(d) Perhaps most important, total victory has ceased to be an immediate prospect for Germany.

5. The official response of the Propaganda Ministry to this situation has been to present Total Victory against Total Annihilation as the only real alternatives for the German people.

6. Should the tide of the war run strongly against Germany it is possible that German public opinion will shift from its present offensive attitude to one of last-ditch defense; and the full power of the Propaganda Ministry will be directed to that end. In that case, a distinct "collapse of morale" may not occur.

7. Barring this eventuality, present evidence seems to indicate that necessary conditions for a "collapse of German morale" are:

(a) serious military set-backs

(b) the universal realization that ultimate defeat is inevitable.

Further drastic reductions in the civilian standard of life are capable of weakening morale in such a way as to make it more susceptible to military reverses.

SECRET

Central European Section

GERMAN MORALE

I. THE SUBORDINATE ROLE OF CIVILIAN MORALE IN THE GERMAN TOTALITARIAN STATE

The fact that Germany is a dictatorship makes the fluctuations of civilian morale of only indirect importance in estimating her striking power. Civilian morale might conceivably sink much lower than it yet has and still cause no decline in Germany's fighting strength. By and large, this fighting strength is a function of three factors--the Army, the Administration, and Industry--all of which are under the firm control of the all-powerful Nazi Party. As long as Party control lasts, civilian morale can wax and wane without exerting any appreciable effect on Germany's war effort.

For the usual concept of "civilian morale" we must therefore substitute, in the case of Nazi Germany, the concept of "total morale," in which the rôle of Nazi domestic propaganda may be as important a factor as the organization of Nazi economy and the striking power of the Nazi military machine.

II. GERMAN "TOTAL MORALE"

Because of the highly organized character of the Nazi system economic, military and political strains are closely interconnected.

The direct effects of a shortage of lubricants, for example, would be a slowing up of production, transportation and even of military striking power. The indirect effect would be a growing suspicion on the part of the public that calculations had gone wrong, that "someone had blundered." And just as one dislocation in the economic system would, if unremedied, inevitably transfer its effects eventually to all parts of the war machine, so any undeniable evidence of blundering on the part of the leaders would, if the situation could not be saved, inevitably result in a collapse of the whole prestige of the Nazi order. In order to reach the public's attention, however, the evidence of blundering would have to penetrate the smoke-screen of justifications which the Propaganda Ministry would undoubtedly throw out in an effort to conceal it.

It is therefore quite conceivable that the Nazi military and economic machine might be on the verge of collapse without the German public's being aware of it. It may accordingly be expected that German "total morale" will not collapse gradually, but very suddenly.

These facts must be borne in mind in estimating the positive and negative factors in German morale. (For details on manpower, transportation, raw materials and food, see the accompanying reports.)

A. Negative Factors in German Morale

1. The Food Shortage

2. The Transportation Shortage

3. The Consumer Goods Shortage

4. The Manpower Shortage

While war casualties are the most dramatic focus of this problem, the manpower shortage has an indirect effect on the whole population through increasing the burden of work which must be shouldered by the survivors. Women are subjected to a double pressure, since they are expected to engage in work outside the home to a much greater extent than in peace time, while they are also put under pressure by the Party to boost the birth rate. Women probably constitute the weakest sector of the German morale front.

It is almost always the enemy, however, not the Nazis, who are blamed for the resulting hardships. Even the casualties, which have undoubtedly brought the severest shock to the home front yet experienced in the present war, do not necessarily lead to resentment against German authorities. They may be justified as a "necessary sacrifice" and as a "small price to pay" for the ultimate gains. Moreover, rather than encouraging a spirit of resignation, losses stimulate the survivors to still greater efforts, in order that "the sacrifices may not have been in vain."

5. The Effect of Air Raids

The effect of air raids on morale appears to be mixed, tending to produce anger and resentment against the enemy (stiffening of morale) as well as fear, apathy and collapse of will to resist. In any case the effect is limited locally to the relatively few places the British have bombed heavily: Muenster, Hamburg, Bremen, Mannheim, possibly Cologne and a few others.

6. The Effect of Allied Propaganda

To be effective this effort must succeed in convincing the Germans that they can get what they want more effectively through an Allied rather than a German victory. The occupied countries will be most ready to accept this line of argument, the pro-Nazi Prussian Germans least ready. The perplexed state of mind of the anti-Nazi Germans is illustrated by a current Viennese toast: "May the war soon be over, even if we should win!"

7. Resentments Engendered by the Nazi Revolution

The Nazi Revolution, aiming to overcome old class lines, introduced two new cleavages in their place: first, it transformed the German Jews into a pariah caste; and second, it created the new elite of Party members and affiliates. Whatever disunities or resentments had been created or intensified by the Nazi Revolution, however, were swept away or at least repressed by the early successes of the war. Even the bitter church conflict cannot be said to have had any appreciable effect on Germany's present war effort. Hated or loved, the Nazi regime and its army are all that stand between the German people and the "inferno" that Goebbels has pictured for them. Nor is there any magic for the Germany of 1941 in the cry, "Back to Weimar!" The prospect of being able to capitalize on recent military conquests is still much too vivid.

B. Positive Factors in German Morale

1. Historical Background

There is an impressive constellation of factors in the German background which work for strong morale: the authoritarian, Prussian tradition, with its emphasis on reticence and obedience, and above all on loyalty to the bitter end; unwavering confidence in the German army, bolstered by its recent "history-making" achievements; belief in Germany's "historical mission" to rule Europe, and even the world; and finally, stark terror at the thought of another even stiffer "Versailles." The German people are not given to insubordination. Nor do they have a high expectation of the good things of life. Both by cultural tradition and by the hard experience of the past 25 years they are trained to tighten their belts and obey orders.

2. The Nazi "Psychological Rearmament" Program

These sentiments and traditions have been fostered and deliberately cultivated in the German mind by a comprehensive program of indoctrination and social control. Begun under the aegis of certain army leaders shortly after the last war, this program was later developed in collaboration with the Nazis and achieved its fullest application after 1933.

The existence of this program of psychological preparation for future offensive warfare bears witness to the good use made by Germans of the lessons of defeat. Of the three types of rearmament which they realized would be necessary if another 1918 were to be avoided, the psychological rearmament was the first to get under way, the economic next, the military last. This was in part because psychological preparation was not forbidden by the Treaty of Versailles, in part because this form of preparation takes longest.(1)

The Germans thus recognized the importance of the morale problem and systematically prepared to meet it. In fact, many Nazi theorists believe that psychological, economic and political campaigns are sufficient in themselves to win wars without resort to military action. (GPW, p.47). The fact that the present war has forced the Germans to concentrate more and more on the purely military aspect may therefore be taken as evidence that the war has not gone according to Nazi plans. December, 1941, is a long way from March, 1938.

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(1) Much of what follows is taken from German Psychological Warfare, the excellent survey put out by the Committee for National Morale, New York, 1941. (Hereafter referred to as GPW.)

The German mobilization for psychological warfare has concentrated on three "morale fronts": the army, the civilian population and the enemy.

3. Morale Building in the Army

Some 200 experts in military psychology are attached to the General Staff. They advise in matters of personnel selection (including promotion) within the army, and in the psychological and ideological conditioning of the soldier. The purpose of this indoctrination, which takes place in the course of daily political discussion periods, is to inculcate an unwavering fighting spirit and desire to defeat the enemy. This end is furthered by relieving the routine of soldierly duties with organized social life and entertainment. It is noteworthy that military instruction emphasizes attack not defense. In fact, the terms "defeat" and "desertion" are consciously excluded from the Army Regulations. The German soldier is trained to expect nothing but victory (GPW, p. 34). The superlative morale and performance of German troops in the present war bear witness to the effectiveness of their fine training. The excellence of military equipment, the efficiency of supplies, the expertness of officer-leadership and the skillful use of symbols and rituals also play their part.

4. Building Civilian Morale

"Army psychologists also advise the Party and the State on (a) selection of political leaders, (b) molding of community spirit, (c) nationalist education for an heroic life, and (d) manipulation of public opinion" (GPW, p.7).

The propaganda organization of the Nazi state is too complicated to be described in a few words. Suffice it to say that the Propaganda Ministry has its representative agencies in every important organization concerned with the guiding of civilian life: for example, the Labor Front, the Labor Service, the Student League, the Women's Organization, etc. All concerned with the indoctrination of the people in Nazi Weltanschauung, these Party agencies supplement the work of the formal educational system and help to prepare Germany against the possible psychological wounds of a prolonged state of war.

The techniques are, in the main, three: (a) argument and persuasion, (b) allocation of material benefits, and, in case both of these fail, (c) the use of intimidation and military discipline. Day after day, hour after hour, the domestic radio provides official rationalizations for official acts. In case the psychological situation is unfavorable, as in air-bombed areas, flagging morale is boosted by extra rations, especially coffee. If unpopular material restrictions must be enforced, the order is held up until the pill can be sugar-coated with some morale-boosting bit of news. (The food-rationing law of last May, it is reported, had been decided upon three months before the Balkan victories made it politic to announce it.) (1)

In the background lurk the Secret Police and Himmler's SS. In Himmler's own words: "We shall relentlessly fulfill our duty to maintain security within Germany just as our conscript army watches over our security from without...for if we ever have to stand the test of war, Germany's fate will be decided on the Home Front." (2)

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(1) Sam Woods, June 16, 1941

(2) H. Himmler, Die Schutzstaffel als antibolschewistische Kampforganisation, Munich, 1936 (GPW, pp. 48-49)

"According to the 1940 National Socialist Yearbook, there were 36 SS-divisions distributed all over Germany, each division consisting of 12,000 men. This means that Germany has at least 432,000 'morale-enforcing' agents, a veritable army of occupation functioning within Germany." (GPW, p. 49)

The questionable effectiveness of this elaborate morale-building program within Germany, under conditions of protracted warfare, is, strangely enough, acknowledged by one of its leading proponents, Kurt Pintschovius:

> "In view of the terrible nature of total war, it has become impossible to enforce the people's will-to-sacrifice indefinitely. It can be done perhaps in the beginning, but later on it is foolish to threaten men with court martial...who have become demoralized under the stress of total war...*Total war is far more likely to prove our curse than our salvation*."(1)

5. Vilifying the Enemy

Of indirect relevance to German domestic morale is the Nazi organization of psychological warfare on the foreign front, since the coordination of information about enemy countries is utilized not only for military intelligence and foreign propaganda campaigns, but for the construction of domestic propaganda programs as well.

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(1) Die seelische Widerstandskraft im modernen Krieg, Oldenburg, 1936 (GPW, p. 49. Italics mine).

A recent article in Das Reich (1) furnishes an instructive example. In order to assemble materials on the English social system 5,000 university students were forced to break off their studies in October, 1939, and become part of a "War Propaganda Organization." English history was searched for evidence to support the thesis: "Perfidious Albion." The archives of philosophy, literature, law, economics, politics, public health, education, etc., were all examined. Among other things, British newspapers, weeklies, and pamphlets from 1900 to 1939 were painstakingly indexed and the materials copied and sorted. Some 20,000 citations were culled, duplicated and distributed to hundreds of German propaganda agencies for both domestic and foreign consumption. The newspapers, the radio, the press all did their utmost with the aid of articles, dramas, and even caricatures. A pamphlet containing some of the "juiciest" items was printed in an edition of 500,000 copies.

One result of all this effort probably has been the formation of German attitudes toward Great Britain today which strengthen German morale by making it relatively impervious to British counter-propaganda.

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(1) "Bausteine der Propaganda," May 4, 1941, p. 8.

6. The Spectre of Defeat

Any estimate of the German attitude toward the war must take into consideration the alternatives confronting the German people. They may not have desired the war. They may not have desired many aspects of National Socialism. Nevertheless, both have come, and both must be endured. The war, once begun, must be carried through to the end; for the only alternative, defeat, is vastly less appealing than a continuation of the struggle, especially since victory appears to the Germans to be not only still a possibility, but even a highly probable outcome. Nazi propaganda spares no device in driving home the dreadful prospects of defeat. The conflict with Russia has permitted them to embellish this theme with the horrors of "Bolshevism." There can be little doubt that the Russian campaign strengthened Nazi domestic propaganda strategy.

Probably no single document is a better index to present German morale than Goebbels' appeal to the nation published in Das Reich, November 2, 1941, (New York Times, November 10), a few excerpts from which follow (italics mine).

> "You are all involved in this struggle whether you want to be or not. Having begun to march, we must march on. There is no longer a chance of withdrawing for any one of us..."

"...more important than the question of when this war will end is the question of how it will end. If we win, all is won: raw materials, freedom, nourishment, Lebensraum, the basis for social reform of our state and the opportunity of full development for the Axis powers. If we lose, all this, and still more, will be lost--namely our whole national existence.

"For that is what is in the minds of our enemies...."

"...We cannot expect even a Versailles that would give us the slightest possibility of national rebirth..."

"Their slogans may sound ever so enticing to the ear of the uninitiated, but behind their sanctimonious humanitarian phrases lurks the naked will to annihilate us. The Axis powers actually are fighting for the most elemental existence, and the cares and burdens that must be laid on all our shoulders in this war would pale before the inferno that awaits us should we lose the war."

"...The chance the German nation possesses today is its greatest, also its last. Every day, every hour, we must keep this clearly in mind.

"The soldier must think of this when he goes to the front. The worker must think of it when he goes to work. The farmer must think of it when he struggles with the soil for the daily bread of his people. The scientist, the official, the doctor, the artist must think of it when they serve the nation in their chosen places.

"That must be our prayer in the morning and in the evening. It must pervade us as the leit motif of our whole existence.

"We can and will win. But it will require gigantic application of the national energies of the entire German people. None dare stand aside, for it concerns all of us. Just as a victorious war redounds to the benefit of all of us, so defeat would crush us."

> "Let us not ask: When will victory come, but instead see that it does come.
>
> "Then some day the hour will come when destiny will bow down before the nation and twine laurels of victory about the brows of those who fought with her. Then the stern, hardened countenances of our people will become illuminated by that glorious moment of rapture for which our century waits."

Goebbels has been quoted at length because his words describe the situation as it appears to the minds of the average propagandized German. The grim alternative, Paradise vs. Inferno, may be wholly unrealistic, but if this is what the Germans have been made to believe it is a factor of major importance for German morale. Only Allied counter-propaganda can hope to eradicate from German minds this grim spectre of defeat.

III. UNDER WHAT CIRCUMSTANCES CAN A "COLLAPSE OF GERMAN MORALE" BE EXPECTED?

From a psychological standpoint the effect of Nazi domestic propaganda, together with the success of Nazi military efforts, has been to produce in the minds of the German people a state of "high morale." This has been achieved despite various factors (indicated above) tending in the other direction.

Taking this "high morale" as a starting point we may distinguish the following four stages in a progression to "low morale":

1. "High" Morale

   a) Complete trust in Hitler (amounting in many cases to what may be called a "Fuehrer Cult").

b) Optimism about the course of the war.

c) Attribution of credit to Hitler and everything German: Army, Party, Labor, etc., and blame to the enemy.

2. "Middling" Morale

   a) Complete trust in Hitler.

   b) Pessimism about the course of the war.

   c) Attribution of credit to Germany and blame to the enemy.

3. Deteriorating Morale

   a) Complete trust in Hitler.

   b) Pessimism about the course of the war.

   c) Attribution of blame in part to Germany and in part to the enemy.

4. "Low" Morale

   a) Distrust of Hitler.

   b) Pessimism about the course of the war.

   c) Allocation of blame almost wholly to Germany, especially the Nazi Party.

These four types may be taken as a rough indication of lines of division in German civilian morale. Within this frame of reference German morale of today appears to fluctuate between types 1 and 2. What variations there are occur only with respect to more or less ephemeral expectations of military success. Thus far the Army, the Party and above all the Fuehrer have been by and large immune to attack.

Despite the inconclusive character of intercept material as a reflection of civilian morale, one observation stands out. Nowhere, in the midst of hundreds of passages bewailing the war, the privations at home and especially the sacrifices in lives and materials at the front, nowhere is there apparent a weakening of trust in the Fuehrer. Blame for the catastrophe, where blame is attributed, is laid at the door of the enemy, especially the "despicable Russians." Hitler is never viewed as responsible for the carnage. On the contrary, he is the ever-watchful, ever-wary guardian of "his" German people, who has been forced, by the devilish plottings of other countries, to take painful but necessary counter-measures. If this impression of German sentiments is correct, then the result must be taken as proof of the extraordinary effectiveness of Nazi domestic policies.

The hoped-for "Collapse of German morale" cannot, therefore, be expected to take place until after (1) a preliminary weakening of the war machine (including the economic foundations) which is (2) so decisive in its effects as to shake the people's confidence in their leaders and (3) so striking in its appearance that not even all the wiles of the Propaganda Ministry could conceal or justify it.

Thus far no weakening of this magnitude has appeared.

Finally--perhaps the most important point of all--even a Germany that was losing the war and knew it was losing the war could be expected to put up a last ditch struggle, unless Allied propaganda is better able than it has been so far to put across a message of hope. The spectre of revenge from the conquered peoples and especially from the Russians would spur them on to a fight of desperation.

IV. CONCLUSION

Available evidence fails to indicate any considerable weakening of German morale. The Nazi dictatorship, by its skillful use of propaganda, bribery, and coercion, appears to have the situation well in hand despite the buffets of more than two years of war. If military and economic developments go against Germany the people may grow resentful at Nazi leadership; but they cannot be expected to revolt, and they will probably keep up a struggle till the end.

Effective Allied counter-propaganda could conceivably shorten the war, provided the Allied war effort convinces the German people that the military situation is hopeless.